Idaho Nonpoint Source Program

2003 Field Evaluation Progress Report

Idaho Department of Environmental Quality

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Summary

During the summer and fall of 2003, staff from the Department of Environmental Quality (DEQ) Technical Services Division evaluated fieldwork related to thirty-two nonpoint source (NPS) water quality enhancement contracts (Figure 1). These evaluations are detailed in twenty-eight individual reports (four of the projects include two contracts each) covering a variety of best management practices (BMPs) related to recognized NPS categories, including agriculture, hydrologic habitat modification, transportation, and urban storm water runoff.

> All 2003 field evaluation reports, including photographs of all 32 contracted projects, can be accessed using the links in *Table 1*, page 11.

Four projects are highlighted in this year's annual progress report because they exemplify outstanding coordination, design, and implementation:

- Jim Ford Creek Watershed Enhancement Project
- Thomas Fork Stream Bank Protection Project
- Medicine Lodge Creek Total Maximum Daily Load (TMDL) Implementation Project
- Paradise Creek TMDL Implementation Project

> Descriptions of the four highlighted projects can be found in *Outstanding Projects*, starting on page 15.

Introduction

DEQ currently oversees approximately 50 NPS regional projects in Idaho, with each project assigned a contract number. If projects are extended to several years, with additional tasks and funding, additional contract numbers may be assigned to a project area.

All projects are subject to field inspections by DEQ, with DEQ's Nonpoint Source Program manager having set a goal to evaluate the progress of at least half of all current projects annually, assuring that the projects are completed in a timely manner and achieving their overarching goal of cleaning up and preventing NPS water pollution. During the summer and fall of 2003, staff from the DEQ Technical Services Division exceeded that goal by inspecting 32 of 50 on-going NPS contracted projects (Table 1).

Figure 1: Locations of 2003 Nonpoint Source Projects

History of the Nonpoint Source Program

Congress established the national NPS program in 1987, when it amended the Clean Water Act with section 319, "Nonpoint Source Management Programs." Under section 319, states were given the federally-funded mandate to address NPS water pollution by 1) conducting statewide assessments of their waters, 2) developing NPS management programs to address those waters identified as impaired or threatened, and 3) implementing Environmental Protection Agency (EPA)-approved, federally-funded NPS management programs to clean up and prevent NPS pollution.

Initially, grants were awarded on a competitive basis to any state that wished to apply. Then, in 1995, EPA recognized that all states had developed maturity in effectively working to clean up and prevent NPS pollution and invited all 50 states to apply for grants on a non-competitive basis. This new approach allowed federal funds to be more widely distributed among the states, while still requiring that all projects meet certain strict standards. At that point, the EPA and the states formed the *Association of State and Interstate Water Pollution Control Administrators* (ASIWPCA), which led to the current NPS framework.

In Idaho, NPS funding has resulted in over 100 contracts for on-ground projects designed to clean up and prevent NPS pollution. Of the 100 projects undertaken since the inception of the NPS program, Idaho currently oversees approximately 50 on-going projects. Each project is described in detail through formal contracts established between DEQ and a variety of permittees, including federal and state agencies, and nonprofit organizations.

Field Evaluation Process

DEQ used its list of NPS field project requirements to generate a detailed form for staff to use for field evaluations. For all evaluations, DEQ staff carefully reviewed the project's sub-grant agreement and made notes prior to going to the field. The DEQ project evaluator routinely contacted the project manager and arranged to accompany the project manager, DEQ regional staff, and any other stakeholders to the field. In all cases, the detailed evaluation form was used as a guide to assure that all NPS requirements were being met in the field.

Results of the 2003 Field Evaluations

DEQ staff traveled to 25 geographical areas of Idaho and evaluated 32 contracted projects during the summer and fall of 2003 (Table 1).

Of the 32 contracts evaluated, 28 appear to be fully meeting their contractual obligations by demonstrating substantial progress toward completion of their designated tasks to reduce, eliminate, or prevent NPS water pollution. Three contracts appear to be proceeding unsatisfactorily, and work on one contract has been delayed until next year.

Unsatisfactory Project Progress

Two of the projects where unsatisfactory work is occurring include storm water BMPs at the City of Blackfoot and storm water BMPs at the City of Pocatello.

During our evaluation of the Blackfoot projects (Contract Number S020) DEQ learned that the Blackfoot Tribe, who own adjacent land, has elected to not let the City of Blackfoot use their land at the outflow end of both retention ponds involved in this project. This denial of land use will cause the storm water capacity of one pond to be reduced considerably and will cause the other pond to not function as a flow-through facility as originally designed. No further 319 funds should be spent on either pond until this problem can be solved.

During our evaluation of the City of Pocatello's North City Park Wetland project, DEQ discovered that there seems to be a problem with the proposed location of the bioinfiltration/wetland facility. It appears that the area selected for the wetland and bioinfiltration basin will not be maintainable without the installation of a costly irrigation system. An irrigation system would be required because the bottom of the proposed wetland would be situated too far above the water table for the wetland to be self-sustainable. It is also unclear whether the conveyance pipeline and outlet that has already been installed will work properly in a storm event. After discussing the project with DEQ engineers and the city engineer, it is suggested that no additional 319 funds be spent on this project until these issues have been resolved.

Satisfactory Project Progress

The great majority of the projects evaluated in 2003 are proceeding satisfactorily. The project evaluations covered a variety of best management practices (BMPs) related to recognized NPS categories, including agriculture, hydrologic habitat modification, transportation, mining, and urban storm water runoff.

Projects evaluated include irrigation water cleanup, wetland creation, and settling ponds in south-central and southeast Idaho; Animal Feeding Operation (AFO) relocations, stream bank restoration, livestock exclusion, and restoration of an abandoned mine dump near Yellow Pine, in north-central Idaho. Finally, in the watershed above Winchester Reservoir, DEQ evaluated pollution prevention measures, including low-till and no-till farming techniques, and lake water cleanup techniques in Winchester Reservoir, including lake water aeration.

Table 1 lists all 32 of the NPS contracted projects that were evaluated in the field during the summer and fall of 2003. These 32 contracts occurred at 28 project sites around Idaho.

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Table 1: Active Nonpoint Source Projects Field Evaluated Summer/Fall 2003

Grant Year	Contract[a]	Project Name	HUC or SRC[b]	Tasks or BMPs Evaluated	DEQ Region
2000	Q609	Bear River Fencing and Riparian Enhancement	16010202	Stream bank stabilization, fencing, grazing plans, weed control.	Pocatello
2000, 2001	Q607 and S020	Blackfoot, City of, Engineered Wetland and Urban Runoff	17040206001834	Two storm water retention ponds.	Pocatello
1998,1999	Q529 and Q366	Coeur d' Alene Tribe Wetland Creation and Restoration/Lake Creek – Plummer	1701030423	Sediment control BMPs for dirt roads.	Coeur d' Alene
2003		Cedar Draw Coulee Wetland	17040212000914	A series of three serpentine shaped ponds that will be interconnected with riparian wetland areas.	Twin Falls
2003	S093	Edson Fichter Nature Area	17040208000017	Revetments, seeding along stream bank, restoration of 700 feet of meandering stream channel, installation of 300 feet of pipe to convey water to a settling pond, installation of a small settling pond.	Pocatello
1999	S029	H 17 Drain TMDL Implementation Plan	17040209000034	200 feet long, 50 feet wide, sediment basin installed at bottom end of six-mile long irrigation canal; captures sediment from return irrigation water prior to discharge to Goose Creek and Snake River.	Twin Falls
2002	S055	Hailey Big Wood River Improvement	17040219	Placed 1,300 feet of stream bank stabilization. Constructed four rock-drop structures. Removed highway maintenance material adjacent to river. Planted woody and grass vegetation along bank and filter strip. Removed illegal landfill, including asbestos. Installed half-acre settling pond/wetland used for normal river flow and storm water runoff.	Twin Falls
2001	S015	Jim Ford Creek Watershed Enhancement	17060306	Road rocking and culvert installation. Six miles of exclusion fencing. 9200 willow cuttings, 3300 lodgepole pine seedlings, 1100 dogwood seedlings, 2500 Hawthorne seedlings, 100 alders, 100 cottonwoods, and 200 spirea planted. One-quarter mile of stream rehabilitation and re-alignment completed.	Lewiston

Grant Year	Contract[a]	Project Name	HUC or SRC[b]	Tasks or BMPs Evaluated	DEQ Region
	S041	Kinsey Corral relocation Note: This project has been delayed and will be completed next year.	17040212001190	Visited current location of Kinsey corral and discussed the relocation and reclamation of the old site. Observed where 3,500 feet of exclusionary fencing will go to keep livestock out of McMullen Creek. Visited site where the new corral will be built.	Twin Falls
2002	S054	Lemhi Watershed TMDL Implementation	17060204000035	Fencing, diversion berms, pipe line, water troughs, well.	Twin Falls
2003	S079	Main Perrine Coulee Wetland	17040212000273	Future site for a concrete diversion structure, a large (8 acre) settling pond and several wetlands. Features will treat 80 to 90% of all the water coming through Main Perrine Coulee.	Twin Falls
2002	S051	Medicine Lodge Creek TMDL Implementation	17040215050100	Willow clumps, willow pole plantings. Toe rock rip-rap, vertical bundles of willows, V-notch weirs used for drop structures, grass, fencing.	Idaho Falls
2001	S039	North-central AFO Relocation		Relocation of numerous AFOs belonging to 27 operators over five conservation districts. BMPs include corral relocations, hardened crossings, fencing, culverts and water troughs.	Lewiston
1999	Q562	Paradise Creek (Urban) TMDL Implementation	17060108	Wetlands, stream channel restoration, extensive plantings, fencing, woody plant riparian buffers, wildlife habitat structures. Stream bank stabilization, noxious weed control, flood plain restoration.	Lewiston
2000	Q605	Paradise Creek (Rural) TMDL Implementation	17060108	Wetlands – 5 projects totaling 522,700 square feet within 11 wetlands, gully plugs, fencing – 16,000 feet, woody vegetation – 10,547 plants, herbaceous vegetation – 168,680 plants. Stream bank restoration – 18,750 feet, noxious weed control, storm water bioinfiltration ponds, vegetated buffer – 685,364 square feet. (Note: all figures are proposed amounts upon project completion.)	Lewiston
1997	Q297	Pocatello First Street Wetland	17040208	Three-acre combined wetland and retention/evaporation basin.	Pocatello
2001	S022	Pocatello North City Park Wetland	17040208	One small catchment basin constructed, conveyance pipeline and infiltration sump installed, large bioinfiltration wetland basin could be constructed in oxbow to Portneuf River	Pocatello

Grant Year	Contract[a]	Project Name	HUC or SRC[b]	Tasks or BMPs Evaluated	DEQ Region
1999	Q508	Raft River Riparian and Watershed Demonstration	17040210000126	Rock crossings, rock drop structures-20, stream bank stabilization revetments, 12 diversion structures, 12 weirs, 12 concrete irrigation return flow structures, plantings including willows and grass, grazing management.	Twin Falls
2001	S023	Rapid Creek Riparian Project	17040212000191	Water well and pump, corral modification, pipeline, water troughs, 1,500 feet of fencing, stream bank restoration, grass and woody plantings.	Pocatello
2001	S026	Rock Creek Restoration	17010304	Two storm water detention ponds, stream bank sloping and stabilization geo-matting, seeding, trees, shrubs, sprinkler system, installation of 5000 yards of topsoil, removal of old concrete from a two acre area, installation of two pedestrian bridges across Rock Creek.	Twin Falls
2001	S024	Santa Creek Stream Bank Restoration	17010304	Electric fencing, hard crossings, re-vegetation along stream bank including wild rose, willow, aspen, thin leaf alder, syringa, wild apple, white pine, ponderosa pine, Douglas fir, and larch.	Coeur d' Alene
1999, 2000	Q564 and S009	Scriver Creek Watershed Roads and Forested Lands	17050112	Sediment control BMPs for dirt roads including culverts, gravel road base, road sloping, ditches, two sediment collection/measuring boxes.	Boise
1996	Q444	Sheridan Creek Restoration	17040202	Nine large diversions completed, (one remaining to be completed), 14 miles of fencing, 10 rock check dams, six culverts. Numerous rock drop structures, 0.5 mile of riparian plantings along stream banks, one water well.	Idaho Falls
2003	Not yet assigned	Stibnite Mine Meadow Creek Restoration	17060208000385	Two sub-project areas include the Glory Hole project and Meadow Creek area. Glory Hole BMPs include relocation and stabilization of mine tailings, adjacent to Meadow Creek. Meadow Creek BMPs include construction of a large composting operation, application of compost to reclaimed mine waste piles, additional reclamation of mine waste piles, installation of stream bank plantings	Boise
2001, 2002	S016, and S053	Thomas Fork Stream Bank Protection	16010102	Numerous rock barbs, 13,267 feet of stream bank sloping and rip-rapping, 13,267 feet of stream bank plantings including grass and woody vegetation, 10,000 of fencing, drop fencing for variable flows, one 18 foot wide and 66 foot long bridge across Thomas Fork River, one manure separator, one wetland complex.	Pocatello
2000	Q606	Willow /Boulder Creeks BMP Implementation	17050123	Fencing, hardened crossings, trees and scrubs, stream bank restoration and stabilization, cattle exclusion, pest management.	Boise
2002	S043	Winchester Lake In-Lake Phosphorous Reduction	17060306	Five electric powered aerators installed on Winchester Lake, one fish cleaning station.	Lewiston

Grant Year	Contract[a]	Project Name	HUC or SRC[b]	Tasks or BMPs Evaluated	DEQ Region
1999	S011	Winchester Lake Upper Lapwai Creek Watersheds	17060306	Nine fish friendly culverts, filter strips between cultivated fields and dirt roads, no-till farming techniques applied to 30% of all cultivated fields, reduced till farming techniques applied to 60% of all cultivated fields, grass planted in intermittent waterways.	Lewiston

a More than one contract number for a project indicates that additional funding was later granted for additional tasks.

b Eight digit numbers indicate Hydrologic Unit code (HUC); 14 digit numbers indicate Stream Reach Code (SRC)

Outstanding Projects for 2003

Four projects in this year's annual progress report exemplify outstanding coordination, design, and implementation:

- Jim Ford Creek Watershed Enhancement Project
- Thomas Fork Stream Bank Protection Project
- Medicine Lodge Creek Total Maximum Daily Load (TMDL) Implementation Project
- Paradise Creek TMDL Implementation Project

Summaries for each of these outstanding projects are presented in the following sections.

Jim Ford Creek Watershed Enhancement Project

Jim Ford Creek in the Clearwater Basin (Figure 2) flows through forested uplands to the city of Weippe then passes through a narrow steep basalt canyon to its confluence with the Clearwater River.

The Jim Ford Creek watershed is managed to reduce pollutants (including sediment, excess temperature, and bacteria) and nutrients (including total inorganic nitrogen and total phosphorus). Nonpoint sources causing impaired water quality include timber harvest activities, rural land use, grazing, non-irrigated croplands, urban runoff, and land development activities. Point sources of pollution include the Weippe wastewater treatment plant, the Timberline High School wastewater treatment plant, and Hutchins Lumber, Inc.

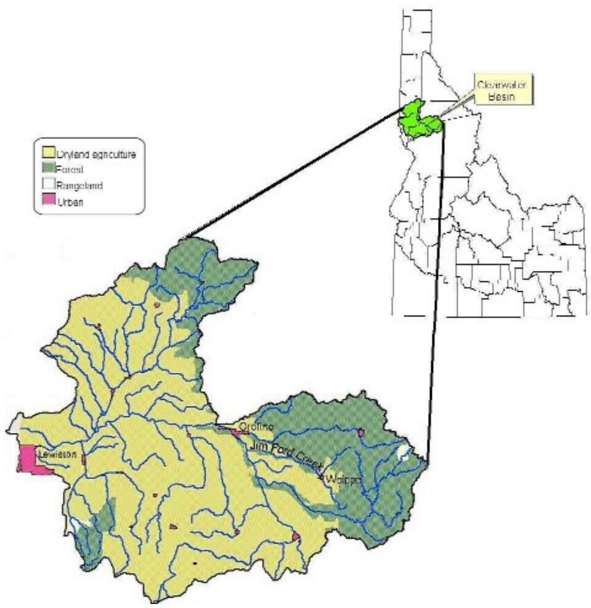

Figure 2: Jim Ford Creek in the Clearwater Basin

<u>*Keys for success*</u>

Three keys for success in the watershed management of nonpoint sources fueled the tremendous cooperative efforts of the Clearwater Soil and Water Conservation District, the Nez Perce Tribe, the Idaho Department of Lands, Potlatch Corporation, and private landowners. First, every agency made an effort toward public outreach, increasing the camaraderie between the agencies and the private landowners. Second, landowners have been and continue to be very proactive in seeking assistance and technical advice from the conservation district. Finally, Clearwater County recognized the value of all of the watershed improvements and increased funding to the conservation district.

Phased Implementation Plan

Figure 3: One of nine rural land use projects

Due to the complexity of riparian systems, restoration efforts take many years to become fully effective. The Clearwater Basin Advisory Group formed the Jim Ford Creek Watershed Advisory Group to develop an implementation plan to reduce the pollutants affecting water quality, and the result is a phased plan with a schedule of activities to reduce pollutant loading to the stream. Table 2 provides a summary of the watershed management projects that have already been accomplished, along with descriptions of the resultant benefits to Jim Ford Creek water quality. Many of the watershed improvement projects are being installed on streams that are tributaries to the mainstem of Jim Ford Creek.

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Table 2. Summary of Watershed Management Projects for Jim Ford Creek

Management Issues	**Collaborative Partners in Watershed Management**	**Watershed Management Projects Accomplished**	**Resultant Benefits to Jim Ford Creek Water Quality**
Forestry Land Use	Idaho Department of Lands Clearwater Soil and Water Conservation District (Clearwater SWCD)	2 miles of fence built, 5 culverts installed, stream rehabilitation, and riparian plantings completed in Miles Creek.	Fencing and culvert installation restores natural drainage pattern and eliminates historic spring flooding that had transported nutrients, bacteria, and sediment to the stream. Stabilized stream banks and restored riparian vegetation, which filters pollutants, reduces erosion, and cools the water.
		1.5 miles of riparian plantings on Wilson Creek.	Restored riparian vegetation, which filters pollutants, reduces erosion, and lowers water temperature.
		Riparian plantings of trees and shrubs on Space Creek.	Restored riparian vegetation, which filters pollutants, reduces erosion, and lowers water temperature.
	Potlatch Corporation Clearwater SWCD	Constructed 6 miles of fence, two new corrals, two cattle guards, and two new stockwater ponds outside of the riparian area, and planted trees and shrubs in the disturbed stream sites on Winter Creek.	Eliminated grazing on 80% of the Winter Creek subwatershed, thereby reducing nutrient, bacteria, and sediment load to the receiving waters. Riparian habitat restoration produced cooler instream temperatures.
		Stabilized and repaired mass failure 100 feet wide by 800 feet long on Green Road, installing culvert ahead of the slump to keep excess water from saturating the fill.	Eliminated further sedimentation and channel movement of a lower reach of Jim Ford Creek that had been previously impacted by the bank failure.
Rural Land Use	Clearwater Highway District Clearwater SWCD	Nine projects in the Jim Ford Creek drainage to line ditches with rock; grade, slope, and rock roads; mat and hydroseed bare slopes; replace ineffective culverts; and build additional culverts (Figure 3).	Ditch armoring has reduced high flows that used to cause gully washing, bank erosion, and increased turbidity, allowing more spring runoff water to infiltrate instead of contributing to overland flow. Properly functioning culverts and vegetated banks reduce sediment contribution to streams.
	Clearwater SWCD Idaho Department of Fish and Game Private landowners	Built 25-acre wetland in the Weippe Prairie with the participation of three landowners (Figure 4).	Livestock exclusion from stream banks reduces nutrient, sediment, and bacteria input to the surface water. Restored wetland vegetation filters pollutants, reduces erosion, and cools the water temperature.
	Clearwater SWCD Private landowners	Improved animal feeding operation facilities for two private landowners with covered manure stacking pads, covered feed bunk mangers, and new corral systems with watering facilities.	Practically eliminated any animal waste from entering surface or groundwater, thereby decreasing nutrient, solids, and bacteria loading to the receiving waters.
Grazing	Clearwater SWCD Bennett Creek Grazing Association	Built new livestock corrals and holding pens outside of the riparian area of the Winter Creek drainage.	Improved livestock containment prevents riparian degradation.
Point Sources	City of Weippe wastewater treatment plant	Removed underdrain from Jim Ford Creek and monitored effluent with a grant from the US Environmental Protection Agency.	Phosphorus and bacteria were below the load allocation.
	Timberline High School	Monitoring and effluent disinfection.	No bacteria detected in effluent
	Hutchins Lumber, Inc.	Storm water plan implemented.	Reduces potential storm water nutrient and sediment load from entering the watershed

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The water quality program for agriculture has accomplished 16 contracts with private landowners since May 2000, using Best Management Practices (BMPs), including the following:

- 10 miles of riparian fencing
- 9 livestock access ramps for heavy-use area protection
- 3 grade stabilization structures
- 2 wildlife and stockwater ponds
- 100 acres of new pasture and hayland plantings
- 1 natural spring development
- 2 feedlot restoration contracts

The continuous conservation reserve program has enlisted 235.5 acres of marginal pastureland for riparian improvements including the following:

- 16,700 tree and shrub plantings
- 9,300 linear feet of riparian fence
- 1 natural spring development
- 3 ramps built for heavy-use area protection

Future Work

Work remains to be done in the Jim Ford Creek watershed: the Lower Ford Creek Road on tribal land of the Nez Perce Indian Reservation will be repaired and improved, the hillside within a road cut will be graded to a gentler slope and stabilized with vegetation, and the road will be realigned, graded, and rocked. All of the repair work will eliminate potential sediment transport to Jim Ford Creek.

Work also continues on the Weippe Prairie wetland restoration. Through landowner participation, the Clearwater Soil and Water Conservation District is working on purchasing 100 more acres of potential wetland to restore the area to a functional wetland.

Figure 4: 25-acre wetland built with participation of three landowners

Thomas Fork Stream Bank Protection Project

(This is an edited, reduced version of a detailed report, titled Thomas Fork Creek Implementation to Rehabilitation, submitted to DEQ from project manager, Mr. Mitch Poulsen of the Bear Lake Regional Commission. Mr. Poulsen's entire photo-essay report, covering seven years of stream bank stabilization progress, is on file with the DEQ State Office.)

Location

The Thomas Fork Watershed encompasses 150,100 acres of Idaho and Wyoming, straddling the southeastern corner of Idaho within townships 10, 11, 12, 13, and 14 south, ranges 45 and 46 east of Bear Lake County, and in western Wyoming within townships 26,27,28,29, and 30 north, ranges 118,119, and 120 west within Lincoln County (Figure 5). The Sublette range bounds Thomas Fork Valley on the east, and the Pruess range bounds it on the west. Mountain elevations in the area range from 6,000 feet to 9,600 feet above sea level. The headwaters are in Lincoln County, Wyoming, as Salt Creek, which changes into Thomas Fork Creek once over the Idaho border. From there, Thomas Fork Creek meanders twenty-seven river miles through Bear Lake County to the confluence of the Bear River, emptying into Bear Lake, which has been designated a "special resource" water by the Idaho Legislature.

Land Use Practices

Agricultural practices represent the greatest use of the valley, with recreation playing a lesser role. Over 90% of the land is planted in harvest crops, such as alfalfa and grain, while the rest is used for dairies and grazing.

No one single practice is responsible for the deteriorated condition of the stream banks along Thomas Fork:

- Irrigation canals traverse the valley floor, providing necessary water to agricultural operations, and this same principle was applied to Thomas Fork to expedite water delivery to downstream users. Meander bends were removed in certain segments in an effort to provide increased efficiency in water conveyance, but straightening the channel increases the head gradient in the stream, which compounded water quality problems from the stream channel to the stream banks.
- Lack of riparian vegetation along many parts of Thomas Fork is an additional source of water quality degradation. Riparian vegetation acts as a buffer strip to remove nutrients from the water, stabilize the soil, and shade the stream. Without this buffer strip, overland erosion is accelerated, nutrient uptake at the root zone is decreased, and the lack of shade increases the temperature of the water. With no root zone to retain the soil in place, the angle of the bank is increased to near vertical. (Survival of vegetation is directly correlated to the slope of a stream bank: as the angle of a bank is increased, vegetation establishment is decreased.)

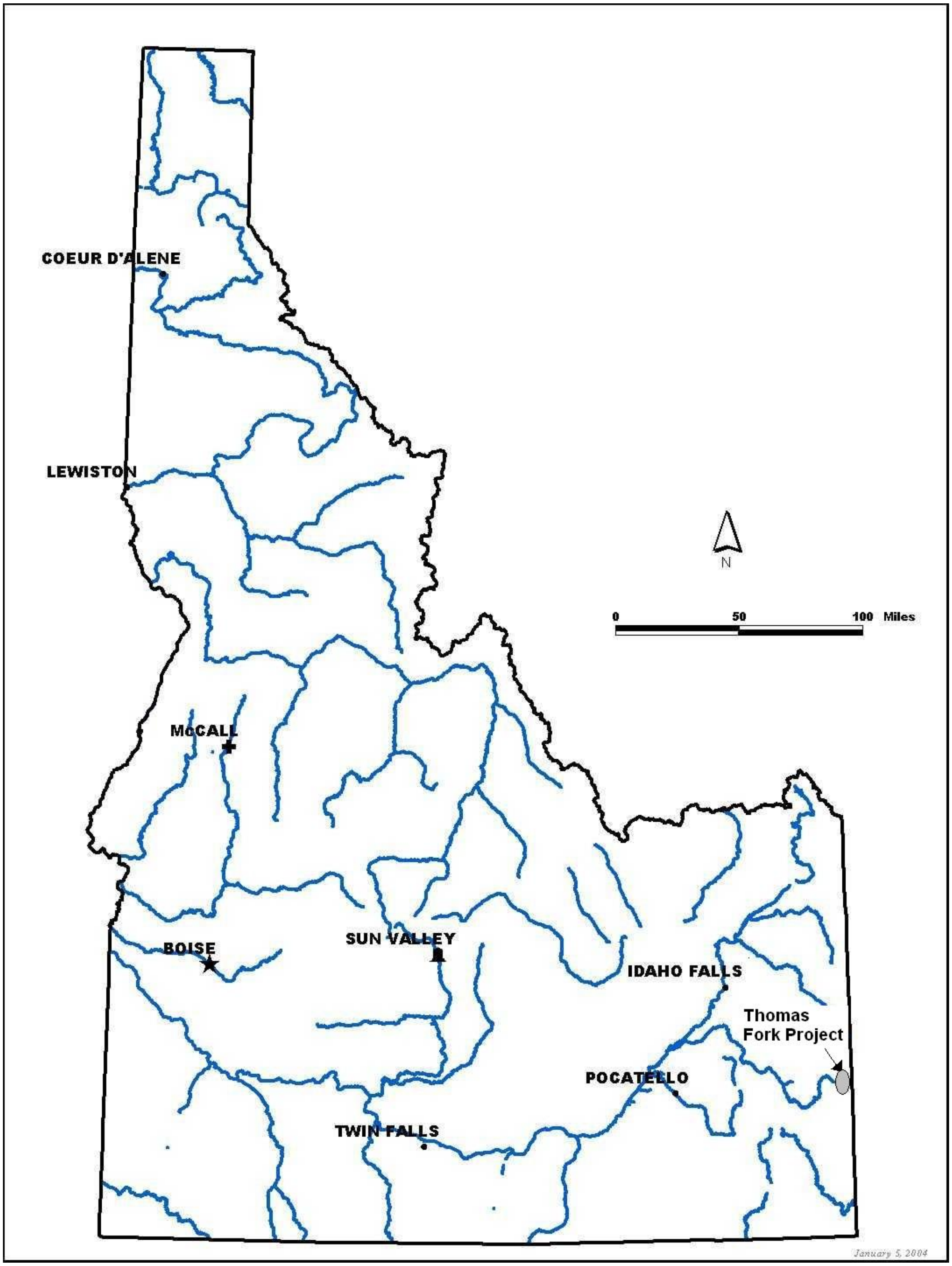

Figure 5: Location map for Thomas Fork Stream Bank Protection Project

Explanation of Best Management Practices (BMPs)

To achieve the purpose of the Clean Water Act that all national waterways be "fishable and swimmable," the Bear Lake Soil and Water Conservation District (BLSWCD) set

Thomas Fork as a priority region within the county to address agricultural issues related to water quality. The State Agricultural Water Quality Plan (SAWQP) produced by the district outlined priority areas of Thomas Fork, those containing the greatest contributors to pollutants, and suggested mitigation techniques to remedy water quality problems.

Eroding stream banks were outlined as the largest single contributor of nutrients (including nitrogen and phosphorus) and sediment to Thomas Fork, and a number of proven mitigation techniques, suggested by the SAWQP plan, have been implemented. To date, 11,262 linear feet of stream bank have been treated with these Best Management Practices (BMPs). The following describes these treatments, in the order they were applied, and their benefits.

Resloping

Stream banks that have been denuded of riparian vegetation are quickly eroded to a slope face of nearly 90 degrees. Heavy construction equipment is used to reduce the angle of these banks to a more stable slope of 2:1 or 3:1, as suggested by the National Resources Conservation Service (NRCS) as suitable for revegetation of riparian species.

Figure 6 illustrates the effect of bank shaping. Left of the trackhoe is a vertical face, nearly 10 feet above the Thomas Fork Creek (at normal flow). A reduced bank angle provides more floodplain for high flows and better dissipates energy associated with those flow events. Moreover, once the angle of the banks has been reduced to a less critical slope, other techniques are applied to keep the stream bank from reverting to a 90-degree angle.

Figure 6: Heavy equipment used to move soil and place large rocks for stream bank stability.

Stabilizing

Soil on stream banks is covered to prevent erosion during rain events or spring runoff. Native rock is placed over exposed soil—local quarries provide the rock, which is hard, angular, and dense—producing a surface (called rip-rap) that is resistant to weathering and high flows. Typically, rock used for this purpose is 8-12" in diameter (Figure 7).

This technique provides temporary protection from wind and rain until grasses and other vegetation can take root and further stabilize soil and uptake nutrients.

The toe of the slope also benefits from this same technique. Rock is laid end-to-end along the water's edge, and this rock, like that used for rip-wrap, is hard, angular, and dense—but of greater diameter. These rocks are typically 2-3 feet in diameter and are placed by trackhoe, one at a time, rather than by the bucket load.

Figure 7: Toe armoring and rip-rap bank protection techniques

Deflecting

Flow is diverted away from sensitive banks with the use of flow deflection structures (Figure 8). Often referred to as “bank barbs” or “points,” these structures are composed of the same material that covers the exposed banks, only larger and placed specifically according to engineered plans. Large rock is laid end-to-end, pointing upstream, at a 45-degree angle from the bank. Smaller rock is then placed over the large rock to fill interstitial spaces and reduce flow velocity between larger rocks. A key trench is dug into the bank to anchor the structure in place.

Figure 8: Flow deflector or ‘bank barb’ diverting flow away from sensitive areas

The purpose of bank barbs is to absorb energy and deflect the flow away from sensitive areas prone to erosion. The flow of the water is naturally diverted over the structure and away from sensitive areas downstream.

Use of bank barbs to deflect flow away from sensitive areas enhances other river processes immediately downstream of the bank barb. As flow is diverted away from sensitive downstream areas, an “eddy” is formed, creating a region of low velocity flow that forms a gravel bar As a result of the gravel bar, the width to depth ratio of the stream channel is reduced, improving water quality for much of the year and reducing the surface area of the stream exposed to the sun, so that cooler water temperatures are achieved.

Revegetation

Revegetation, which provides long-term sediment and nutrient reduction in addition to other benefits, consists of planting willows (Figure 9) and other on-site vegetation, along with broadcasting a native seed mix on affected areas.

Figure 9: Willow cuttings pressed into toe of bank slope

Willow plantings are cut from healthy on-site communities and pressed into the soil at the toe of all affected slopes. Care is taken to ensure contact is made with the water table at the base of the willow cutting, and the cuttings are planted 4 to 6 inches apart during the late fall or early spring. When possible, entire willow stands (willow plantings) and other existing riparian vegetation are transplanted into the toe of the slope along the bank. Planting during dormancy greatly improves chances of survival.

The seedbed is prepared by using a harrowing device, such as the homemade piece of equipment shown in Figure 10. A six by ten foot piece of nine gauge chain link is cabled to a tractor, or other four wheel drive piece of equipment, and pulled over the ground.

Chain link has shown to be optimal in these circumstances due to the fluid nature of the linkage: the chain link disturbs only soil as it “snakes” along over the rocks and other protrusions. Larger harrows, in contrast, get snagged on rocks and are less maneuverable in confined spaces.

As a final step, seed is broadcast by hand just prior to snowfall—at the recommended density of 30 pounds per acre—then treated by dragging a harrow over the soil.

Figure 10: Harrowing soil after broadcasting seed

A native seed mix, blended at a local seed mill and consisting of sheep fescue, crested wheatgrass, and stream bank wheatgrass, was selected based on site conditions, such as soil type and drought resistance of the seed.

Fencing

Once projects are completed, fencing is used to prevent sensitive areas from being grazed or trampled, while still providing access to water for animals. Commonly used in many locations to separate landowner parcels, fencing has been applied and adapted to the riparian area.

Common fencing can be used to separate animals in the pasture from the riparian area, but it is difficult to keep animals on adjacent properties from using the streambed as a conduit to other pastures. Gap fencing, which is devised to prevent use of the streambed as a conduit, provides a solution.

Gap fencing is constructed using a combination of 3/8” steel cable, welded wire panels, railroad ties, and a tensioning device. Posts are pounded into the ground on opposing sides of the stream, and the panels are set out perpendicular across the streambed from one bank to the bank on the opposing side. The cable is threaded through the panels and secured to one of the newly set posts, while on the opposite post a tensioning device is secured and fastened to the thread of panels. This configuration allows the panels to be raised and lowered depending upon stream discharge. (Raising and lowering the panels according to discharge excludes the channel from being used as a conduit. This technique has proven to be 99% effective.)

Water gaps are another method of fencing that allows animals access to the water in limited areas along the creek with minimal damage to the riparian area. Essentially, a water gap is a deviation in the linearity of a fence that runs to the stream and allows one or two animals at a time to drink. With no room to spread out (caused by the fence) or grass to graze, they drink and move on. This method limits the amount of riparian area trampled to a minimum and still provides water for animals. Numerous methods of construction and materials exist for creating water gaps.

History of 319 projects on Thomas Fork

The purpose of this section is to present, using photo documentation, the progress made on the Thomas Fork Watershed over a period of seven years of BMP implementation. Before and after photographs are used to show improvements to treated areas over time. Other pictures illustrate the current condition of projects that have been completed.

Photographs are arranged in reverse chronological order, starting with the most recently completed project and ending with older projects. Additional photographs can be found in Appendix A, while a table of BMPs applied to all Thomas Fork projects can be found in Appendix B of the complete report, which can be obtained through the DEQ State Office or through Mr. Mitch Poulsen of the Bear Lake Regional Commission.

Project #7 (Garth Boehme)

This is the third bank stabilization project that landowner Garth Boehme has participated in. The photos of Figure 11 and Figure 12 were taken in the fall of 2002 and spring of 2003 after construction. Of particular interest is the width of the channel in these photos. Prior to construction, the creek spanned the channel, but after reducing the angle of the bank and constructing a bank barb, the channel width was reduced. Also of interest is the amount of sediment deposited next to the bank. This occurred during a two-month period over the spring runoff. Because of the recently aggraded gravel bar, new emergent vegetation is starting to take root.

The amount of vegetation present at the site has been an asset. We have been able to experiment with different methods of revegetation and have seen some encouraging results. Prolific stands of willow and sedge have been available for transplant, and we have found that by excavating a hole in the bank next to the water's edge entire willow communities can be transplanted. This has also held true for sedge and reed grasses: a plug, for example, can be transplanted from one location on the project to another without disturbing its life cycle.

The benefit of transplanting whole willow plantings can be seen from Figure 13 and Figure 14. This corner was treated using a mix of willow plantings and cuttings, which resulted in vibrant growth within six months.

The difference between planting and cutting is the number and method used for transplant. A planting involves removal of the entire plant, while a cutting is the selective removal of branches. Planting requires heavy equipment to transplant vegetation from one location to another, while cuttings are cut and pressed into the soil at the water's edge.

The light colored willow in the middle of the picture on the left-hand side of Figure 14 was the only standing vegetation on this cutbank prior to revegetation. All of the rest were willow plantings and cuttings. Willow cuttings are present in this picture although less visible.

This project required treatment of 2,163 linear feet of stream bank and construction of 12 bank barbs. Ecological enhancements include three new pool-riffle complexes and re-defined thalweg (deepest point of the channel). Other improvements of interest at this location include reduction in stream width-to-depth ratio at three locations because of newly formed gravel beds.

Figure 11: Prior to implementation of BMPs (Fall, 2002)

Figure 12: Post-BMP implementation (Spring 2003)

Often banks are found to be eroding at transitional areas between cut banks on corners. Figure 13 and Figure 14 illustrate how little time is required for riparian vegetation to re-establish on the banks once the soil is stabilized in place using BMPs. The time lapse between the photos is roughly six months. Treatments along 4,275 linear feet of stream bank and 15 bank barbs were required at this project. Roughly, 2,100 linear feet of log revetments were used as additional retention devices at strategic locations.

Figure 13: Cut banks prior to reclamation

Figure 14: Cut banks six months after reclamation

Project #4 (Heber Boehme)

This project, conducted on landowner Heber Boehme's property, was one of the first along Thomas Fork to address bank stability. Now five years old, riparian vegetation is abundant along treated and untreated banks. Figure 15 shows the ability of vegetation to stabilize the bank when treated and protected.

The vegetation in the picture along the banks is reed canary grass, which is a non-native species. In some locations, this species out-competes the native grass seed mix applied.

Rock provides a temporary solution until a more permanent vegetative cover can be established. This bank was rip-wrapped from top to bottom to keep soil in place until vegetation could establish. Despite the fact that, in purist terms, it should not be used as a remedy for erosion, rock rip-wrap accomplishes the objective of bank stabilization and nutrient uptake and is particularly useful in areas where aesthetics are not as important as functionality.

Conversation with landowners along Thomas Fork has indicated they lose about three feet of valuable farm ground each year because of erosion. After BMPs are implemented, that number is drastically reduced.

Further illustration of the benefit of BMP implementation can be seen in Figure 16. The left side of the picture is Heber Boehme's property after treatment with BMPs and allowing re-establishment of riparian vegetation. The right side of the picture lacks BMPs and an alternative to grazing management. Prior to treatment, both sides of the fence looked like that on the right side. Clearly, implementation of BMPs and landowner cooperation results in a distinct improvement. Bank shaping and other treatments on this project totaled 1,743 linear feet with placement of 13 bank barbs.


Figure 15: Results of vegetation after five years


Figure 16: Illustration of the benefits of treated versus untreated land

Project #3 (Garth Boehme)

Garth's first bank stabilization project was completed in conjunction with several other projects that seek to keep sediment and nutrients out of the Thomas Fork. The photo in Figure 17 was taken six years after treatment, at the downstream terminus of the project from the bridge installed during previous projects. This photograph illustrates the benefit of implementing BMPs on eroding banks and the resulting effect on the channel.

As with many other locations along Thomas Fork Creek, this stretch was much wider during low flow before BMP implementation. Prior to construction of upstream bank barbs and bank shaping at this site, the channel possessed a much greater width to depth ratio. Post-BMP implementation has the streambed in a more confined channel with an aggraded gravel bed that is only submerged during higher flows.

Monitoring indicates that prior to construction the streambed was over twice the current width. The right edge of the photo was the edge of the creek prior to rehabilitation. Rip-wrap placed as temporary treatment has been secondary in benefit to riparian vegetation. This location has a strong community of willows on the opposing bank, where previously only vertical bank was present. The bank on the left-hand side was shaped, and then rip-wrapped. After several years, the rip-wrap is no longer visible and has been completely overgrown with willow communities.

The other benefit in this area is the gravel bed, which has aggraded vertically and horizontally and reduced the channel width. Treatments at this location include: bank shaping along 1,500 linear feet, 900 feet of log revetments, and 15 bank barbs constructed at strategic locations. In addition, 2,000 linear feet of fence were erected for livestock exclusion.

Figure 17: Vegetation and stream channel after six years

Project #2 (Garth Boehme)

In addition to bank stabilization and BMP implementation on Thomas Fork, other upland projects have been completed as well. A manure management facility, consisting of a manure bunker, separator and constructed wetland, has been completed to reduce nutrients entering Thomas Fork (Figure 18). The constructed wetland helps to take up much of the nutrients that previously entered Thomas Fork.

Figure 18: Manure bunker with wetland in the background

A bridge was also constructed at this location to remedy pollution caused by dumping of dairy waste products. Prior to construction, a dairy operation was located on a bluff overlooking the Thomas Fork Valley. Previously, all waste products from the dairy operation were pushed over the bluff adjacent to the stream channel, where they accumulated until they were needed to fertilize cropland. The material was then scooped up and deposited in a manure spreader, which was hauled through Thomas Fork to adjacent cropland.

To remedy this water pollution problem, a nutrient management facility was constructed. Any waste products produced by the dairy are now deposited in the separator, where the solids and liquids are directed to different locations. The solids remain in a concrete bunker until they are spread on cropland. The liquids are piped to a constructed wetland where the nutrients can be utilized by plant material. The bridge allows passage over Thomas Fork without contamination from the manure spreader.

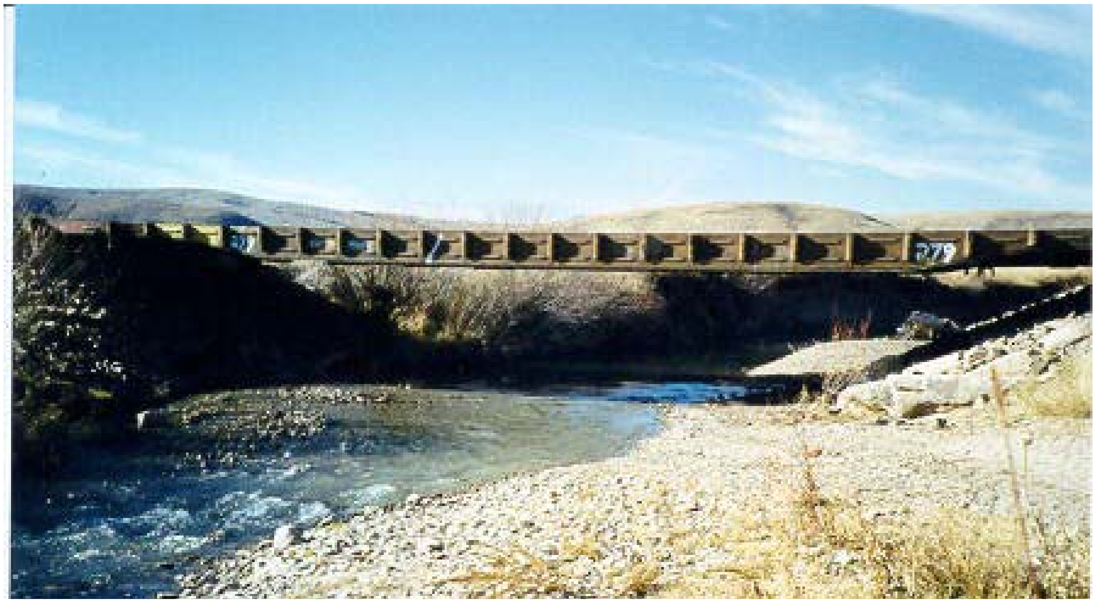

Figure 19: Bridge crossing made from an old railroad flatbed car. Since this photo was taken, vegetation has taken over the flood plain where the photographer stood.

Summary and Conclusion

Non-Point Source § 319 grants have been awarded to the Bear Lake Regional Commission to help landowners along Thomas Fork Creek implement Best Management Practices over seven years. These practices have resulted in over 11,000 linear feet of stream bank being held in place, using such treatments as bank shaping, revetments, rip-wrap, bank barbs, and vegetation.

These projects have proven successful on a number of levels. Treatments applied have retained soil in place for seven years, and photo monitoring of strategic locations has verified this. Cross sectional surveys of the stream have shown the benefit of stabilizing the banks with BMPs.

Results from monitoring indicate that for each foot of treated stream bank, 50 cubic feet of stream bank material was retained on the banks over a three-year period. This retained material per foot, when expanded to the entire treated area, equals over 500,000 cubic feet of material retained in place.

Further success has been noted in landowner perceptions to treatments. Many landowners were skeptical of BMPs implemented on neighboring lands. However, those perceptions have slowly dissolved as projects show success in stabilizing land and enhancing values. Because landowners, along with other sources, help provide the labor and materials necessary for a successful project, this cooperative spirit is crucial to the success of these projects.

The success of bank stabilization work on the Thomas Fork comes from a combination of factors, none of which can stand alone. The cooperation between the State of Idaho Department of Environmental Quality and local landowners provides a strong foundation for successful implementation. Money provided by the state allows construction to proceed, while the landowner ensures success by proper management. Both entities benefit through improved water quality and stabilized soil. The Bear Lake Regional Commission has been pleased to sponsor these projects and act on behalf of the landowners in carrying out implementation of Best Management Practices. It is the hope of the regional commission board members that this relationship will continue for years to come, until Thomas Fork Creek is once again classified as “fishable and swimmable.”

Medicine Lodge Creek Total Maximum Daily Load (TMDL) Implementation Project

Work funded through the NPS 319 grant is treating 35 miles of streams within the Medicine Lodge Subbasin (Figure 20), including Medicine Lodge Creek, Irving Creek, Fritz Creek, and Edie Creek. Work on all of these 303d-listed stream segments will take four to five years with a grant amount of $783,326. This project requires cooperation between the Clark Soil Conservation District, the Natural Resources Conservation Service, the Idaho Association of Soil Conservation Districts, the Soil Conservation Commission, the Idaho Department of Agriculture, the Idaho Department of Environmental Quality, and local landowners.

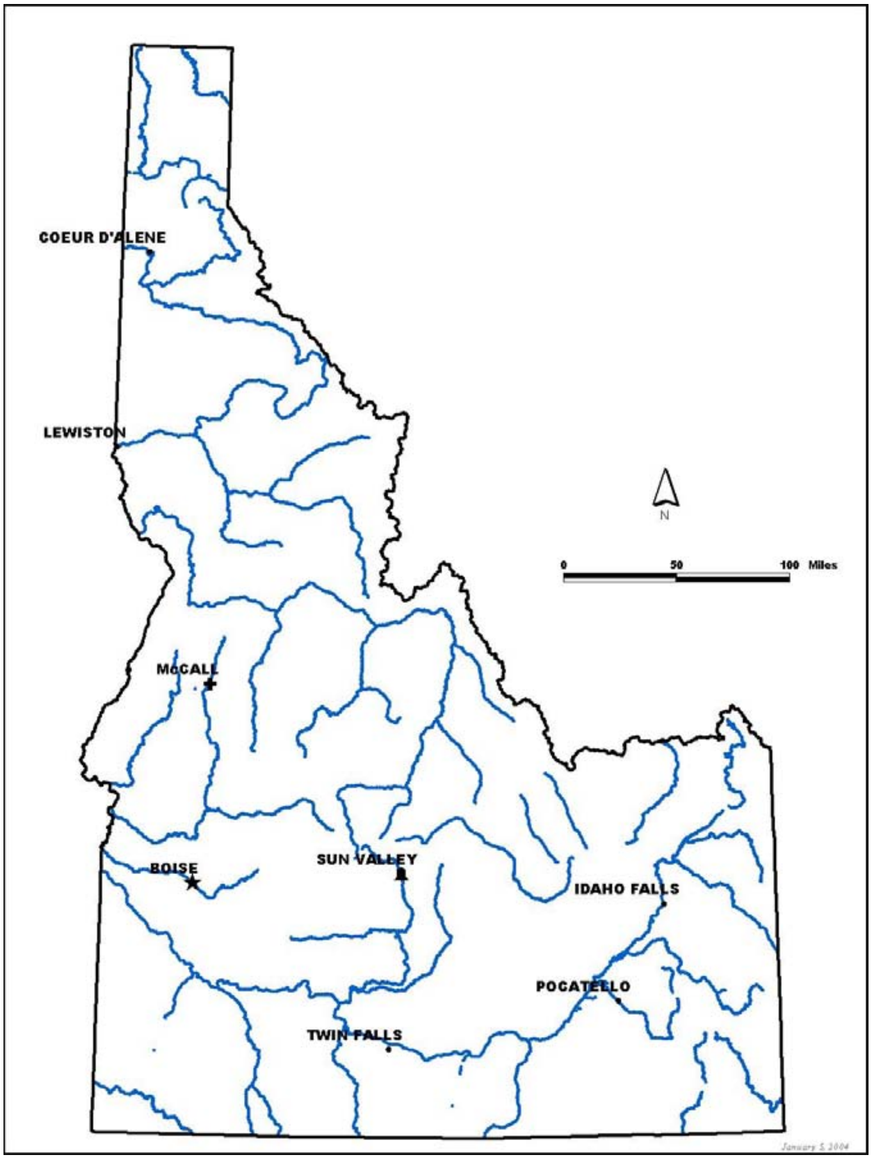

Figure 20: Location Map for Medicine Lodge Creek TMDL Implementation Project

Figure 21: The success of this program depended heavily on convincing local ranchers and landowners that State and federal agencies would work with them to improve water quality without negatively impacting ranching operations.

Figure 22: Problems that are routinely found along Medicine Lodge Creek include unstable, steep stream banks caused by improper grazing techniques. This problem has been exacerbated by unusual weather patterns over recent years.

Figure 23: One solution to bank erosion is to carefully place rip-rap and woody vegetation at the toe of the bank. With time, this bank will become completely vegetated and stabilized.

Another common problem along Medicine Lodge Creek is that confined animal feeding operations (CAFOs) have historically been placed in and adjacent to streams in order to provide water for livestock. The CAFO seen in Figure 24 used to be located in Irving Creek. This facility was recently relocated away from Irving Creek and now has water piped into it.

Figure 24: Confined Animal Feeding Operation relocated away from Irving Creek

Adjacent to the 35 miles of stream length being treated, there are more than 1,527 acres of riparian area to be treated as well. The Best Management Practices (BMPs) being implemented in these areas include prescribed grazing systems, corral systems, water gaps, hardened crossings, exclusionary fencing, vegetation revetments, clump plantings, rock V-weirs, and stable concrete irrigation diversions.

Figure 25: Vertical slopes from overgrazing were knocked down. Rip-rap and willows were added to stabilize the bank. This looks unsightly now but will appear quite natural after one or two growing seasons. The biodegradable silt fencing will break down.

Figure 26: The stream bank in the foreground has been re-sloped, stabilized with rip-rap, and replanted. The vertical stream bank in the background has not yet been rehabilitated.

Figure 27: Willows were planted as horizontal bundles and as transplanted rooted clumps. All woody plants are locally derived. Many of the vertical banks were stabilized at their toe with large rocks and woody plants. The upper bank will slough back until stabilization is naturally achieved. Vegetation will then continue to establish itself naturally.

Figure 28: One effective method for planting willows involves the use of a water jet. This high-pressure water injection technique allows quick and easy planning of willow cuttings several feet deep along the bank and within the water table.

Figure 29: These willow cuttings were planted using water jet injection.

Each vegetative revetment consists of several large trees, carefully embedded along the stream banks, to create a slower moving stream velocity where previously faster moving water was causing erosion. By cutting select trees on nearby forest service land, an additional benefit is gained: thinning the trees and reducing the fire danger in the adjacent forest.

All of these BMPs are being applied with the ultimate goal of restoring coldwater aquatic life and beneficial uses on 35 miles of stream bank along Medicine Lodge Creek. This goal is achieved by reducing stream bank and stream channel erosion; improving grazing management with planned grazing, pasture or exclusion fencing; decreasing sediment, nutrient and bacteria concentrations; reducing livestock concentration with off stream water developments; buffering streams with grass, shrubs and trees; and stabilizing eroding stream banks and channels using stream re-naturalization techniques.

Figure 30: Within several years, all of the areas shown in the previous photographs will look as good and function as well as this section that was completed just two years ago.

Figure 31: Stabilized stream bank

Figure 32: Some of the members of the Basin Area Group (BAG) that supported the Medicine Lodge Creek project. Lloyd Bradshaw (second from right) is the project manager.

Paradise Creek TMDL Implementation Project

Paradise Creek Urban Riparian Restoration

The Paradise Creek Urban Riparian Restoration Project began in 1999 and continues to date. This summary contains pertinent information, including photographs for the following rural sub-projects:

- Berman Creekside Park: Stream bank Stabilization and Riparian Planting
- Bridge Street Park & West Bridge Street: Stream bank Stabilization, Floodplain and Riparian Planting
- Carol Ryrie Brink Nature Park: Remeander Construction, Wetland Construction, and Riparian Planting
- Chipman Trail Riparian Planting (2 projects)
- East Mountain View: Meander, Floodplain and Wetland Construction and Riparian Planting
- Fire Station Stream Bank Stabilization and Riparian Planting
- Fosberg Riparian Planting
- Good Samaritan Village Project Riparian Planting
- Guy Wicks Field Riparian Planting
- Leffingwell-Reid Wetland Construction and Revegetation
- Lefors Wetland: Wetland Construction and Riparian Planting
- Lightfield Stream bank Stabilization and Riparian Planting
- Meadow Street: (2 Projects) Stream bank Stabilization and Riparian Planting
- Mountain View Park: Riparian Planting
- Nichols Project: Backyard Stream Bank Stabilization and Riparian Planting
- Orchard Wetland: Wetland Construction and Riparian Planting
- Renaissance Charter School: Riparian Planting and Habitat Structure Installation
- State Line Project: Stream bank Stabilization and Riparian Planting
- Streets: Wetland Construction and Riparian Planting
- Styner: Riparian Planting
- Sweet Avenue: Meander, Floodplain, Wetland Construction, and Riparian Planting
- White Avenue: Stream bank Stabilization and Revegetation

All of these sub-projects are located on public or private land in the urban portion of the Paradise Creek watershed, within the City of Moscow (Figure 33).

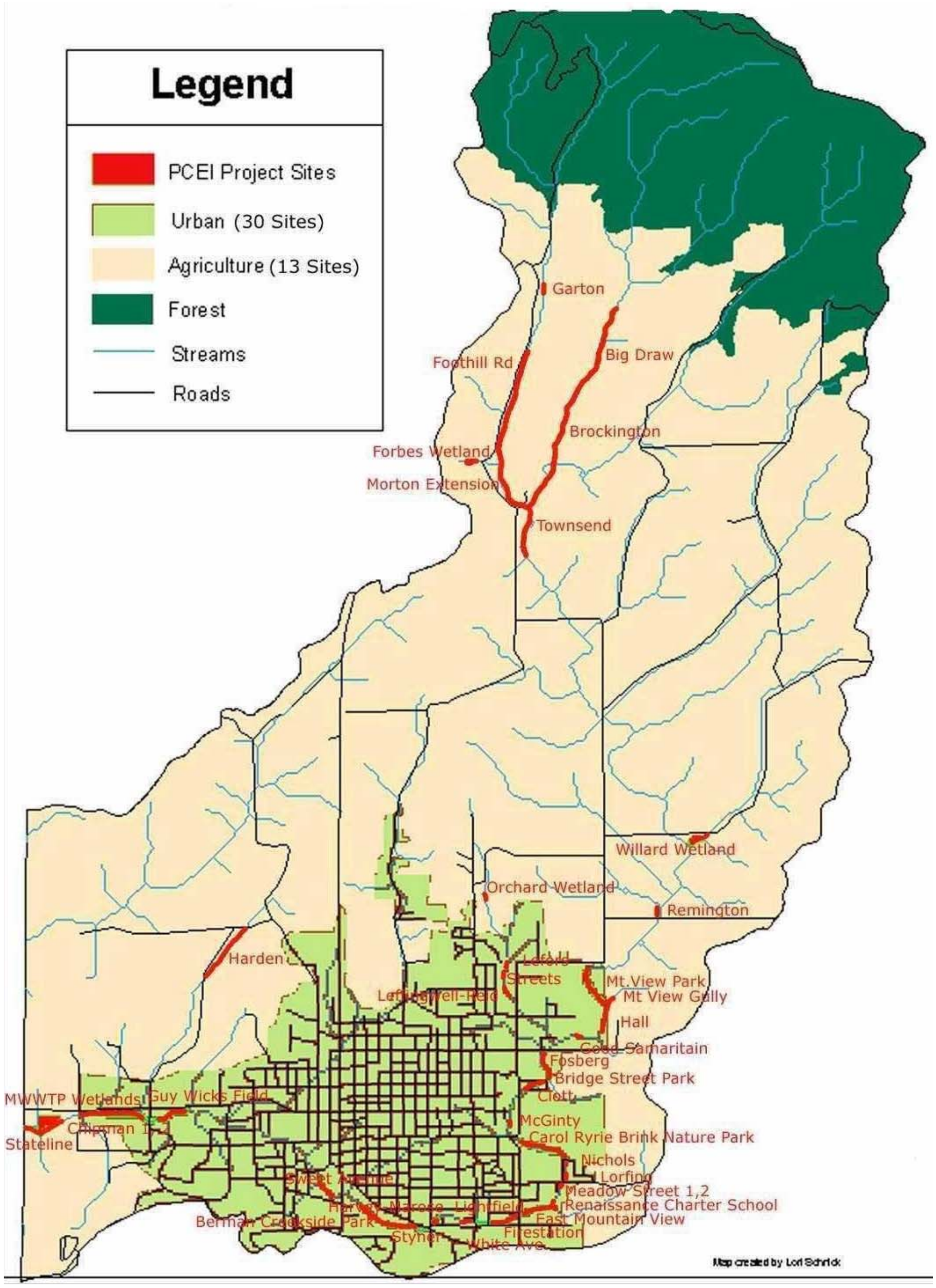

Figure 33:Paradise Creek Watershed Urban and Rural Projects, Moscow Idaho

Berman Creekside Park: Stream bank Stabilization and Riparian Planting

Project partners and local matching funds for this project came from the City of Moscow, Girl Scout troops, Bill Styer, Washington State University (WSU) students, University of Idaho students, AmeriCorps National Civilian Community Corps (AmeriCorps*NCCC), and community volunteers. The project took place during Spring 2001 and Spring 2002. The project, involving 1,183 feet of stream bank restoration, is located at Berman Creekside Park in Moscow. The tree-revetment was installed at the west end of the park, on the south bank of Paradise Creek. Plantings were done along the north stream bank of Paradise Creek within the park.

Previous Conditions: Much of the stream segment had nearly vertical, slumping, eroding stream banks that were frequently undercut by high water events, contributing to the sediment load in the creek. The majority of the stream bank soil was exposed, except for a few patches of reed canary grass. Where Paradise Creek flows through the park, it is lined by golden willows, a non-native willow species that discourages a diversity of riparian trees and shrubs and threatens power lines above. There were also areas of steep, eroding banks.

Description of Completed Activity: The purpose of the tree-revetment was to stabilize and revegetate a 150-foot section of eroding stream bank, reducing the amount of sediment entering the stream and providing habitat for fish and wildlife. A cedar/fir revetment was constructed by the AmeriCorps*NCCC team during the summer of 2001. This involved securing 18 fallen trees along the base of the outside bank with cables and posts. Once that was completed, the upper bank was sloped back and covered with erosion control fabric. Native woody vegetation was planted in the spring of 2002 (Figure 34 and Figure 35).

Plantings were done on the north side of Paradise Creek to stabilize the bank and add plant diversity in the riparian zone. Girl Scout troops, Moscow Charter School students, University of Idaho students, AmeriCorps*NCCC, and community volunteers planted trees, shrubs and donated native wildflowers. Donated plants planted during Spring 2001 came from the USDA Plant Materials Center and the University of Idaho Forest Nursery (Table 3).

Table 3. Native riparian plant species planted in Berman Creekside Park, Moscow, Idaho during Spring 2001.

Native Plant Species	Scientific Name	Number Planted
Serviceberry	Amelanchier alnifolia	18
Paper birch	Betula occidentalis	20
Red-osier dogwood	Cornus stolonifera	43
Nootka rose	Rosa nutkana	2
Bebb willow	Salix bebbiana	50
Douglas spiraea	Spiraea douglasii	120
Snowberry	Symphoricarpos albus	16
Mixed cuttings		144

On the flat bench of land on the north side of the creek, across from the Conrad Smith plantings, a variety of native Palouse prairie wildflowers were planted. Christine Nauman at the University of Idaho donated many of these plants. Dave Skinner at the Pullman NRCS Plant Materials Center donated native wildflowers and bunchgrasses left over from other propagation experiments (Table 2).

Table 4. Wildflower species planted at Berman Creekside Park, Moscow, Idaho in Spring 2001.

Wildflower species	**Scientific Name**	**Number Planted**
Prairie Smoke	Geum triflorum	50
Smooth alumroot	Heuchera	50
Sunflower	Helianthella uniflora	150
Grass-widows	Sisyrinchium bellum	30

Figure 34: Berman Creekside Park Fall 2000

Figure 35: Berman Creekside Park Summer 2001

Bridge Street Park & West Bridge Street: Stream bank Stabilization, Floodplain and Riparian Planting

Partners and local matching funds came from the City of Moscow, University of Idaho, AmeriCorps*NCCC, TerraGraphics Environmental Engineers, Evian Spring Water, Project WET, and numerous community volunteers. The project took place during 2001, with plantings completed in spring 2002. The project, which is located within a city park and on adjacent private property in Moscow, includes approximately 325- and 100-foot sections of stream, respectively.

Previous Conditions: These stream segments had slumping, eroding banks that were frequently undercut during heavy storm events, contributing sediment to Paradise Creek (Figure 36). In addition, annual dredging artificially widened and incised the stream channel, causing raised water temperatures during low flow periods of the year. Reed canary grass was the dominant vegetation along this stream segment. Few trees or woody vegetation grew along the stream segment.

Description of Completed Activity: The purpose of the Bridge Street Park project was to reconfigure approximately 450 linear feet of a straight, ditch-like creek to a low-flow channel with a terraced floodplain. Approximately 390 cubic yards of soil were excavated from this site. The newly constructed low-flow channel has a 3 to 4 foot bottom width, much reduced from the prior width of 8 feet, and will convey 1.5 to 2 year flows (Figure 37). Approximately 195 cubic yards of the excavated soil were used as backfill to create the two-tiered floodplain, with soil wraps to increase the flood storage capacity of this reach. These geotextile fabric-wrapped soil “burritos” were stacked one upon the other, and seeded with native grasses. Each soil wrap is about 6 feet wide and one foot high. The floodplain was constructed to 20 feet wide on the west side of the stream in Bridge Street Park. The local 10-year flood elevation was decreased by a maximum of 0.2 feet. The 100-year flood elevation was decreased by 0.1 feet upstream of the project. In the fall of 2001, woody shrubs and trees were planted along the bank to shade the stream.

The West Bridge Street site was a stabilization of an additional 100-foot stream segment, just downstream of the Bridge Street Park project. The steep stream banks were resloped to reduce the amount of sediment entering the stream. Palouse-Clearwater Environmental Institute (PCEI) staff and the AmeriCorps*NCCC team laid out erosion control blankets and installed coconut fiber-filled BioLogs® pre-planted with wetland plants along the stream banks to stabilize the toe of the slope and to improve water quality by reducing nutrients through the water-filtering qualities of wetland plants.

Figure 36: Bridge Street Park early Spring 2001

Figure 37: Bridge Street Park Summer 2001

Carol Ryrie Brink Nature Park: Remeander Construction, Wetland Construction, and Riparian Planting

Partners and local matching funds came from the Moscow School District, Bon Terra, Potlatch Corp, United States Department of Agriculture (USDA), Wilson Tree Service, Washington State University Community Service Learning Students, University of Idaho, AmeriCorps*NCCC, Christine Nauman, and many community volunteers.

The project, including 1,200 feet of stream bank restoration and two wetlands covering 60,000 square feet, was constructed during 1995. The project is located where Paradise Creek flows from the corner of Sixth Street and Mountain View Road to the cul-de-sac at the end of Meadow Street.

Previous Conditions: Paradise Creek was straightened and channelized by former owners, creating unstable banks lacking riparian vegetation. The land adjacent to the stream was an active wheat field, and plant diversity along the stream channel was low. The creek was heated by direct solar radiation. The water quality was impaired by direct, un-buffered flows of storm water runoff. Wildlife habitat along the creek was minimal.

Description of Completed Activity: The floodplain and stream banks were restored through excavation, stabilization, and planting of native riparian species. In the fall of 1995, it took Roach Construction of Genesee, Idaho one week to excavate a 5-acre floodplain and remeander 1,200 feet of stream channel. Excavation activities moved 12,000 cubic yards of earth. Volunteers, including Moscow schoolchildren, University of Idaho and Washington State University students, and community members, built three 175-foot revetments for stabilization and demonstration purposes, including a log-crib revetment, a BioLog® revetment, and a root-wad and rock revetment. PCEI volunteers seeded and mulched over 3,000 square feet of stream bank and 5 acres of floodplain, installed over 6,000 square feet of geotextiles, and planted over 750 native plants. In total, it took about 2,000 volunteer hours to construct this project. The site (Figure 38) was later christened the “Carol Ryrie Brink Nature Park,” named for the popular author who grew up in Moscow.

Figure 38: Carol Ryrie Brink Nature Park

Chipman Trail Riparian Planting (Two projects)

Project partners and local matching funds came from the City of Moscow, Washington State University students, University of Idaho students, AmeriCorps*NCCC, and many community volunteers. The first restoration site, including the first mile of the Bill Chipman Trail in Moscow, consists of 2,100 feet of stream bank restoration.

Previous Conditions: Weedy banks, devoid of woody vegetation, characterized this confined reach of Paradise Creek. The channel was dredged in the past and was wide, with steep, vertical banks. These conditions left the stream with eroding banks, high water temperatures, and minimal habitat value (Figure 39).

Description of Completed Activity: To stabilize the banks, native willow poles from the Wildlife Habitat Institute were planted with a post-hole tool on an excavator along the stream. In addition, over 2,000 native trees and shrubs were planted in approximately 40 foot wide buffer strips on either side of the creek (Figure 40). These will grow to shade the stream, helping moderate stream temperatures. Woody riparian buffers offer many benefits, including filtration of runoff, wildlife habitat, and floodwater retention. These plantings were protected from vole and beaver damage with plastic tubes, and were watered and weeded for the first two years. The City of Moscow Parks Department also cooperated with PCEI to plant native trees along the Chipman Trail, which parallels the project site. This, in essence, expanded the buffer width on the north side of the stream to approximately 75 feet.

The second site consists of 1,799 feet of stream bank restoration where more willow poles were planted along the upstream end of the project. The willows will provide shade to reduce stream temperatures, stabilize the steep stream banks, and contribute woody material to the stream. Maintenance of past plantings, including watering and weeding, was performed during the summers of 2002 and 2003.

Figure 39: Chipman Trail Fall 1999

Figure 40: Chipman Trail Summer 2002

East Mountain View: Meander, Floodplain and Wetland Construction and Riparian Planting

Partners and local matching funds came from TerraGraphics Environmental Engineering, AmeriCorps*NCCC, City of Moscow, Washington State University Environmental Science students, Moscow elementary school students, Synthetic Industries, Boy Scout troops, and community volunteers. The project took place from July 22 until September

10, 2002 with most planting completed in September and October of 2002. Additional plantings were completed in Spring 2003.

The project, located across from the Latah County Fairgrounds in Moscow, included 1,720 feet of stream bank restoration and two wetlands covering 5,260 square feet.

Previous Conditions: This reach of Paradise Creek had a straightened, excessively wide channel with nearly vertical, eroding stream banks. The stream channel had been straightened, deepened, and widened by years of dredging (Figure 41). The steep banks were undercut during high flows, contributing to the sediment load in the creek. Reed canary grass was the dominant bank vegetation, and no native woody vegetation was present to control bank erosion or shade the stream.

Description of Completed Activity: Up to two feet of soil was removed from the entire project area to remove fill that had been deposited streamside and restore a more functional floodplain. A new 1,720-foot channel with three meander bends was constructed to replace the 860 feet of the straight, ditch-like channel resulting from continuous dredging (Figure 42). The newly constructed low flow channel has a bottom width of 3 feet and a depth of 1.5 feet. Banks were sloped at 3:1 in order to limit bank erosion and allow for the establishment of native vegetation.

The newly constructed channel was stabilized with a variety of bank stabilization treatments, such as bank revetments, which were placed in zones susceptible to scouring along outer bend banks. Extensive revetments were required due to the flashiness of this stream and downstream sediment concerns. Bank revetments will also restrict the movement of the channel. This is important due to the constraints of the urban environment. Bank revetment types used at East Mountain View include log crib revetments, buried log crib revetments, root wad revetments, soil wraps, and coir log revetments.

Two wetlands were constructed approximately 1-1.5 feet in depth and have a 5:1 slope on each side. They will filter agricultural runoff from a small tributary and runoff from streets and the apartment complexes south of the project.

All bare soil was seeded with native grasses following construction. Native herbaceous vegetation, such as small-fruited bulrush, common rush, and Nebraska sedge were planted along the toe of the channel slope. Red-osier dogwood plugs and willow plugs and poles were planted on the stream banks to provide long-term bank stabilization and to shade the stream. A mix of native trees and shrubs, including aspen, ninebark, Nootka rose, ponderosa pine, syringa, and serviceberry were planted on the floodplain.

PCEI worked with a Moscow Boy Scout, who earned his Eagle Scout badge by building an observation deck at this site. Interpretive signs are due to be installed in 2004. This site was the host of the 2002 Paradise Creek Watershed Festival.

Figure 41: Before Spring 2000

Figure 42: East Mt. View late Winter 2002

Fire Station Stream Bank Stabilization and Riparian Planting

Partners and local matching funds came from University of Idaho Students, Latah County Youth Services, Washington State University, and AmeriCorps *NCCC. The project, completed during Fall 2002, included 190 feet of stream bank restoration. The project installation date was September 2002.

Previous Conditions: The stream segment had nearly vertical, slumping, eroding stream banks contributing to the sediment load in the creek. There was also a lack of native woody vegetation close to the creek for shade. Paradise Creek had been dredged in this reach many times, which added to its degraded state.

Description of Completed Activity: This project stabilized a highly impacted area of the stream bank and added a riparian buffer. Due to the confined nature of the stream at this point, and the close proximity to the Moscow Fire Station, a small area of rip-rap was placed in conjunction with coconut fiber Biologs® along the upstream portion of the project. Erosion control fabric was installed on the remaining portion of the stream bank. The Biologs® were planted with native herbaceous plugs. All exposed stream banks were seeded with native grasses, and woody shrubs were planted on the banks and at the top of the stream bank (Figure 43).

Figure 43: Fire Station Stream Bank Stabilization

Fosberg Riparian Planting

Partners and local matching funds came from Maynard and Margaret Fosberg, University of Idaho, Palouse Land Trust, Natural Resource Conservation Service, AmeriCorps*NCCC, and community volunteers. The project was completed in 2000 and includes 1,370 feet of stream bank restoration and 1,370 feet of exclusionary fencing.

Previous Conditions: This site was previously used as pasture and the landowners decided to retire the land from grazing, so the property was entered into a land easement with the Palouse Land Trust. The riparian area was dominated by a monoculture of reed canary grass, which provides little shade, sediment retention, or wildlife habitat (Figure 44).

Description of Completed Activity: Native trees and shrubs were planted adjacent to Paradise Creek to establish a riparian buffer strip (Figure 45). The woody vegetation will shade the stream, control stream bank erosion, and contribute woody debris to the stream system. PCEI also installed protective tubes to prevent animal damage to plants.

Figure 44: Fosberg area prior to planting

Figure 45: Fosberg area after riparian planting

Good Samaritan Village Project Riparian Planting

Project partners and local matching funds came from Good Samaritan Village, Moscow School District, and community volunteers. The project installed during Fall 2002 includes 171 feet of stream bank restoration.

Previous Conditions: The site is on Good Samaritan Village grounds adjacent to Paradise Creek. To the north is a large, impervious parking lot at an elevation approximately 3 ft above the project site, thus the project site receives runoff associated with the parking lot. There were two drainage paths running from north to south in the project area that support turf grass but are wet much of the year. There are several 50-year old conifers and a manicured hedge west of the site that shield the site from Eisenhower Street. Paradise Path is south, between the project area and Paradise Creek. The path is heavily used by residents of Good Samaritan village and other neighborhood residents for walking, running, skating or bicycling to Mountain View Park. The project area was primarily covered with turf grass except for a few quaking aspen planted by the Good Samaritan grounds crew.

Description of Completed Activity: Native trees and shrubs were planted to increase biodiversity of the riparian zone and improve habitat. PCEI and our partners planted serviceberry, Douglas hawthorn, ocean spray, syringa, Douglas spirea, and quaking aspen. These plants, between the Good Samaritan parking lot and Paradise Creek, will help filter runoff from the parking lot.

No photographs are available

Guy Wicks Field Riparian Planting

Partners and local matching funds came from the University of Idaho, Latah Soil & Water Conservation District, Natural Resource Conservation Service (NRCS), Palouse Ocularium, AmeriCorps*NCCC, and community volunteers. The project took place during Spring 2002 and includes 1,136 feet of stream bank restoration.

Previous Conditions: Weedy banks, devoid of woody vegetation, characterized this confined reach of Paradise Creek. The channel was dredged in the past and was wide, with steep, vertical banks.

Description of Completed Activity: Guy Wicks Field is located on the University of Idaho Campus near the Pullman Highway on the west side of the campus. Austrian pine, Scotch pine and lodgepole pine were planted along Paradise Creek, adjacent to Guy Wicks Field, on both sides of the stream. Plants were donated by NRCS and planted by AmeriCorps *NCCC members and PCEI staff. Maintenance was performed during the summer of 2003.

No photographs are available.

Leffingwell-Reid Wetland Construction and Revegetation

Partners and local matching funds came from Jeanne Leffingwell, James Reid, the City of Moscow, and community volunteers. The project took place during Summer 2003 and included 650 feet of stream bank restoration and construction of 8,420 square feet of wetlands in three areas.

Previous Conditions: Prior to restoration, this Paradise Creek tributary was a straight, incised channel. Reed canary grass was the predominant species, with a vigorous infestation of Canada thistle and morning glory. The site had few native trees and shrubs, grasses and forbs. The stream reach was exposed to direct solar radiation as well as storm water runoff containing sediments, nutrients, and pesticides.

Description of Completed Activity: This urban riparian restoration project is a demonstration of the effectiveness of creating and maintaining a riparian wetland area in the Paradise Creek watershed. The long-term goals of the project include establishment of native riparian vegetation, improved water quality, and increased habitat for wildlife.

To accomplish these goals, a narrow meandering stream channel and three associated wetlands were constructed. Wetlands vary in depth from 1 to 2.5 feet. Professional Operators Company excavated the site with a track hoe, using an 18-inch toothed bucket. The construction phase took approximately three days to complete. The wetlands are adjacent to the new channel to receive and filter runoff before entering the stream and to increase flood storage capacity (Figure 46).

Community volunteers helped seed the site with native grasses and install geotextile fabric on newly constructed banks. Wetland transplants and herbaceous plugs were planted along the stream channel, as well as in and around the three wetlands. Stream banks and wetland edges were seeded with native grasses, including tufted hairgrass, ticklegrass, fowl bluegrass, western managrass, prairie junegrass, and Idaho fescue. The riparian area was also planted with herbaceous species (small-fruited bulrush, common rush, creeping spikerush) and native woody species (red osier dogwood, sandbar and Mackenzie willow [plugs], quaking aspen, Douglas hawthorn, Nootka rose, serviceberry, shiny leaf spirea, and syringa).

Figure 46: Leffingwell-Reid property after work was complete in Fall 2003

Lefors Wetland: Wetland Construction and Riparian Planting

Partners and local matching funds came from AmeriCorps*NCCC, TerraGraphics Environmental Engineers, University of Idaho students, Washington State University students, and community volunteers. The project was constructed during Fall 2002 and included 972 feet of stream bank restoration, 486 feet of fencing, and construction of 6,211 square feet of wetlands in two areas.

Previous Conditions: The site is located along a tributary to Paradise Creek north of the Streets Wetland site. A horse barn on the east side and a wide, flat wet area to the west bordered the stream segment. The site is inundated with water for a significant portion of the year, and this condition made the site suitable for wetland construction. Reed canary grass was the dominant vegetation along the stream segment. Few trees or woody vegetation was present. A horse pasture adjacent to the wetland site contributed associated pollutants to the stream.

Description of Completed Activity: The construction of wetlands along this Paradise Creek tributary will improve flood control, provide quality habitat for wildlife, and filter and trap pollutants. The wetlands also provide recreational and educational benefits to the community.

During September 2002, two shallow wetlands were constructed at the site (Figure 47). The wetlands range from a width of 30 ft to 134 ft and are approximately 140 ft in length with an organic shape. The wetlands' depth ranges from 1ft to 1-1/2 ft. The wetland design allows the waters of the adjacent stream to enter into the area while providing a defined channel for water movement in low flow situations.

After excavation, native woody shrubs, trees, and grasses were planted along the bank and around the wetlands. Herbaceous wetland plants were planted in the wetland to help improve water quality by reducing nutrient loading through filtering. Native willow species and red-osier dogwood cuttings were planted along the banks of the stream to secure the banks and introduce shade to the system.

Figure 47: Construction of Lefors Wetland

Lightfield Stream bank Stabilization and Riparian Planting

Partners and local matching funds came from Kirk Lightfield, the City of Moscow, and community volunteers. The project was constructed during Summer 2003, along a stretch of Paradise Creek located between Blaine Street and Lynn Street, 918 White Avenue, Moscow, and consists of 200 feet of stream bank restoration.

Previous Conditions: The stream segment had nearly vertical, slumping, eroding stream banks that contribute to the sediment load in the creek. Reed canary grass was the predominant species on this stream reach. There was a lack of existing native woody vegetation close to the creek to help shade out weeds and decrease water temperature. In the past, this reach of Paradise Creek was dredged, which exacerbated the steep banks and promoted incising (Figure 48).

Description of Completed Activity: The construction phase of the project was completed September 23, 2003. Moscow contractor Dale Stubbs excavated the existing bank to create a 2:1 slope. Slope construction took approximately six hours using a 48-inch toothed bucket. Bio-logs were installed at the toe of slope to provide a shelf for plant material and bank stabilization. The coir logs were terraced two high on the upstream section of the project, this technique used to minimize undercutting in an area of high velocity. The re-sloped bank was promptly seeded with native grasses (tufted hairgrass, ticklegrass, fowl bluegrass, western managrass, prairie junegrass, and Idaho fescue), herbaceous plants (small-fruited bulrush, common rush, creeping spikerush) and native woody species (red-osier dogwood, sandbar and Mackenzie willow [plugs], quaking aspen, Douglas hawthorn, Nootka rose, serviceberry, shiny leaf spirea, and syringa) (Figure 49).

Figure 48: Lightfield Stream bank before work

Figure 49: Lightfield Stream bank after work

Meadow Street: (Two Projects) Stream bank Stabilization and Riparian Planting

Partners and local matching funds came from the Nez Perce Soil and Water Conservation District (SWCD), U.S. Department of Agriculture Natural Resource Conservation Service (USDA-NRCS), University of Idaho, AmeriCorps*NCCC, and community volunteers. The project was constructed during Spring 2000 over a stream bank interval of 365 feet.

Previous Conditions: The stream channel was impacted by urban development and past land use practices. The riparian area was degraded due to water flow barriers, such as concrete walls, chunks of concrete dumped in the creek, and the steep gravel embankment along Meadow Street before the bridge across Joseph Street. Reed canary grass was the dominant cover type. These conditions degraded the stability of the inner stream bank. Undercutting and bank failure was a common result.

Description of Completed Activity: The site on the Lorfing property, located on the east side of the creek along Meadow Street, was manually constructed with help from the Summer 2000 AmeriCorps*NCCC team. The stream bank of the 65-foot section was resloped and then stabilized with three bioengineering techniques. A fascine, or long bundle of red-osier dogwood cuttings, was placed along the toe of the bank, where its rooting would be stimulated by contact with water. Vertical bundles of red-osier dogwood were installed in shallow trenches, running from the creek up the bank. Pre-planted coconut fiber BioLogs® were tiered along the toe of the bank for stabilization during the higher winter and spring flows. The entire area was seeded with a native riparian grass seed mix and then covered with erosion control fabric.

The second phase of this project included a 300-foot section of stream, in which an excavator removed a leaning concrete wall and the fill material associated with it. Then a two-tier floodplain was created along the length of the project. In total, 66 dump trucks of soil were removed, and over 50 live red-osier dogwood (*Cornus stolonifera)* poles were planted. The exposed stream banks were seeded with a native riparian grass seed mix, which was covered by erosion control fabric. In the fall of 2000, native riparian vegetation was planted. Additional plantings were completed in the spring of 2001.

No photographs are available.

Mountain View Park: Riparian Planting

Partners and local matching funds came from the City of Moscow, Animal Clinic, University of Idaho, Washington State University Community Service Learning Students, University of Idaho Wildlife Society, Saturday of Service (SOS) volunteers, AmeriCorps*NCCC, community volunteers. The project located at Mountain View Park, east of Mountain View Road in Moscow, has been worked on intermittently from 1999 through 2001 and covers 2,140 feet of stream bank restoration.

Previous Conditions: This section of stream was dominated by a monoculture of reed canary grass, with no native woody vegetation. Most of the banks had a moderate slope, but portions were eroding into the creek due to the absence of vegetation. The lack of riparian cover increased water temperatures in the unshaded stream. Storm water runoff from adjacent parking lots and playing fields flowed directly into the stream.

Description of Completed Activity: Beginning in 1999, a variety of volunteer groups helped plant 1,100 trees and shrubs along the tops of the stream banks. In spring 2000, 600 plants were planted and in the fall an additional 500 plants were planted at this site. All plantings have protective tubes installed around them (Figure 50). These plantings will eventually create a riparian forest buffer along the creek, shading the stream, filtering runoff, and enhancing wildlife habitat and aesthetics. In 2001, PCEI staff and volunteers replanted vegetation in areas of low survival and performed maintenance of previous plantings, including weeding, tube removal and watering. The Mountain View Park site was also the headquarters of the Annual Paradise Creek Clean-Up.

Figure 50: Mountain View Park plantings

Nichols Project: Backyard Stream bank Stabilization and Riparian Planting

Partners and local matching funds came from Bon Terra, University of Idaho, AmeriCorps*NCCC, and community volunteers. Completed in 2000, the project involved stream bank restoration on Paradise Creek along a 60-foot interval of a residential back yard.

Previous Conditions: The western side of Paradise Creek on this property was severely eroded and was slumping into the creek. Reed canary grass formed a dense monoculture whose shallow root mats promoted slumping of the stream bank. Thus, the stream banks were frequently undercut during heavy storm events. The lack of trees or woody vegetation along this stream segment also allowed solar radiation to heat the stream water, which decreases dissolved oxygen and is damaging to aquatic wildlife.

Description of Completed Activity: The area of concern along the western stream bank is about 60 feet in length. Restoration activity occurred from the creek edge to about 9 feet up the west stream bank for this previously mentioned length. BioLogs® were installed to secure the toe of the slope. The site was also planted with native vegetation and willow poles to assist in securing the banks

No photographs are available.

Orchard Wetland: Wetland Construction and Riparian Planting

Partners and local matching funds came from Joanne Reese and Bill Voxman, Bon Terra, University of Idaho, Nez Perce Tribe, National Tree Trust, AmeriCorps*NCCC, TerraGraphics Environmental Engineers, University of Idaho students, and Washington State University students.

The project, located along a draw west of Mountain View Road between Mountain View Road and Cleveland Street in Moscow, included wetland construction over an area of 14,019 square feet during 2001. Also, native trees and shrubs were planted along 146 feet of stream bank during Fall 2001, with additional planting during Spring and Summer 2002.

Previous Conditions: This site is located in a low-lying area, containing few trees or woody vegetation, that feeds a tributary to Paradise Creek.

The site is inundated with water for a significant portion of the year, and this condition made the site suitable for wetland construction. Reed canary grass was the dominant vegetation along the stream segment, and few trees or woody vegetation were present. A horse pasture upstream of the site contributed associated pollutants to the stream.

Description of Completed Activity: The purpose of the Orchard Wetland project was to create a wetland to filter the nutrients and sediment from the farm fields and from adjacent livestock areas. Approximately 1000 cubic yards of soil were excavated from this site and moved to another location on the site to create a terrace. The newly constructed wetland has a 4-5 foot bottom with a higher 3 ft excavation in the center of the wetland that fulfills the “shallow excavation” criteria of the 319 NPS grant. The wetland area was planted with woody vegetation as well as wetland vegetation to help improve water quality by reducing nutrients through the water-filtering qualities of wetland plants. The banks of the wetland area were secured with geotextile fabric and were seeded with native grasses. In the spring of 2002, willow poles and red osier dogwoods were planted along the banks to secure the banks and introduce shade to the system. Additional native plantings were planted in the spring of 2002 (Figure 51).

Figure 51: Orchard Wetland

Renaissance Charter School: Riparian Planting and Habitat Structure Installation

Partners and local matching funds came from the City of Moscow, Washington State University students, University of Idaho, AmeriCorps*NCCC, Renaissance Charter School staff and students, and community volunteers. The project located, along Paradise Creek behind the Renaissance Charter School on the south end of Meadow Street in Moscow, includes restoration of 379 feet of stream bank. This work was accomplished during October of 2002.

Previous Conditions: The stream segment had nearly vertical, slumping, eroding stream banks that were frequently undercut by high water events, contributing sediment to the creek. The majority of the stream bank soil was exposed, except for a few patches of reed canary grass. Where Paradise Creek flowed by the school, it was lined by golden willows, a non-native willow species that discourages a diversity of riparian trees and shrubs and threatens power lines above.

Description of Completed Activity: Willow poles and other native riparian plant species were planted along the stream banks and on the floodplain (Figure 52). These native shrubs will help stabilize the failing stream banks, shade the stream, and introduce woody material to the stream system. Charter school students helped with the planting, and ongoing plant maintenance. In addition, students worked with PCEI staff to install log habitat structures.

Figure 52: Renaissance Charter School riparian planting

State Line Project: Stream bank Stabilization and Riparian Planting

Partners and local matching funds came from AmeriCorps*NCCC, Moscow Wastewater Treatment Plant, University of Idaho Farm Operations, Nez Perce Soil and Water Conservation District (SWCD), University of Idaho, Washington State University Service Learning, and many community volunteers. The 2001 project, located immediately downstream of the Moscow Wastewater Treatment Plant near the Idaho/Washington state line, involved restoration of 2,040 feet of stream bank.

Previous Conditions: Stream banks along this segment of Paradise Creek were eroding due to a lack of woody vegetation and the steepness of the banks. Reed canary grass formed a dense monoculture whose shallow root mats promoted slumping of the stream bank. Thus, the stream banks were frequently undercut during heavy storm events. Moreover, the lack of trees or woody vegetation along this stream segment also allowed solar radiation to heat the stream water, which decreases dissolved oxygen and is damaging to aquatic wildlife.

Description of Completed Activity: The main purpose of this project was to stabilize and revegetate a 1,020 foot section of stream to provide habitat for fish and wildlife, shade to reduce stream temperatures, a vegetated buffer from agricultural runoff, and a means to reduce the amounts of sediments entering the stream. Earth moving was completed by University of Idaho Farm Operations. PCEI staff, volunteers, and the Summer 2001 AmeriCorps*NCCC team completed the other bank stabilization activities.

The steep stream banks were resloped to either a 2:1 slope (in areas where space is limited due to the proximity of a road) or to a 3:1 slope (in sections of the stream where space is not limited). Construction of these more gradual slopes reduces erosion, reconnects the stream to its floodplain, and creates an area to plant native vegetation. The resloped banks were seeded with a riparian grass mixture and covered with geotextile fabric. Native woody vegetation was planted during the fall.

All the soil and material that was excavated to recontour the stream banks was moved off site. Where feasible, concrete was removed from the stream channel. The removal of concrete will allow vegetation to be planted along the stream to provide habitat for fish and wildlife. In selected areas, coconut fiber-filled BioLogs®, pre-planted with wetland plants, were installed along the toe of the stream bank to stabilize the bank and to help improve water quality through the water-filtering qualities of wetland plants.

Willow *(Salix exigua, Salix Drummondia, Salix mackenziana)* and red-osier dogwood *(Cornus stolonifera)* poles and dogwood fascines were planted on the stream banks where the initial vegetation did not establish well. Through time, the poles will provide a dense network of interconnected roots to hold the bank in place and catch sediment and organic matter to facilitate the establishment of other vegetation (Figure 53).

Figure 53: State Line stream bank stabilization and riparian Planting

Streets: Wetland Construction and Riparian Planting

Partners and local matching funds came from AmeriCorps*NCCC, TerraGraphics Environmental Engineers, Renaissance Charter School, Lapwai Elementary School, and community volunteers. During Fall 2002 and Spring 2003, restoration of two wetlands, covering 14,019 square feet and 732 feet of stream bank, was completed in a draw between Mountain View Road and Cleveland Street. This location is behind a residence in Moscow.

Previous Conditions: The site is on a tributary to Paradise Creek in a draw. The stream segment was bordered by a steep bank on the east side and a wide, flat wet area to the west. The site was inundated for a significant portion of the year, which made it a suitable location for a wetland. Reed canary grass was the dominant vegetation along the stream segment, and few trees or other woody species were present. The site was directly downstream from a horse pasture and was impacted by associated pollutants entering the water from upstream.

Description of Completed Activity: Two shallow, excavated wetlands were constructed at the site. The wetlands range from 40 to 80 feet wide, are approximately 275 ft long, and have an organic shape. The depth of the wetlands ranges from 1 to 2.5 ft. The wetland area is fed by runoff and a spring located in the northern portion of the project. In addition to the spring, the wetland design allows the waters of the adjacent stream to spill out, over into the wetland area while providing a defined channel for water movement in low flow situations. A berm, located on the east side of the stream, was removed to allow for the extension of the floodplain. Approximately 895 cubic yards of soil was excavated from this site. The excavated soil was relocated onsite.

Wetlands were constructed on the tributary to Paradise Creek to improve flood control, provide native habitat for wildlife, and filter pollutants. The constructed wetland also provides recreational and educational opportunities for the community. Native species of woody shrubs, trees and grasses were planted along the bank to provide shade to the stream and wetlands and wildlife habitat. Herbaceous wetland plants were planted in the wetland to help improve water quality by reducing nutrient loading through filtering. All plantings are protected from animal damage with plastic tubes.

Native willow and cottonwood cuttings were planted along the banks of the stream to secure the banks and introduce shade to the system, creating a woody riparian buffer. Woody riparian buffers offer many benefits, including filtration of runoff, wildlife habitat and flood water retention. PCEI also organized a day of camas planting with students from Renaissance Charter School and Lapwai Elementary School. The students learned about the ecological and cultural significance of the camas from a member of the Nez Perce Tribe and helped restore the plant to its native Palouse Prairie (Figure 54 and Figure 55).

Figure 54: Streets site before planting

Figure 55: Streets site after planting

Styner: Riparian Planting

Partners and local matching funds came from the City of Moscow, Girl Scout troops, Russell Elementary School students, Potlatch Corporation, and community volunteers. The project work, located on Paradise Creek between Styner Avenue and Idaho State Highway 8, took place in Spring 2002 and included 448 feet of stream bank restoration.

Previous Conditions: This stream reach had been routinely dredged by the City of Moscow, and the dredge spoils had been dumped on the stream bank. Consequently, the stream channel is excessively wide and uniform, with steep, very high banks. Reed canary grass, Canada thistle, and prickly lettuce were the only vegetation on the stream banks.

Description of Completed Activity: Willow poles were planted along the stream bank for erosion control and to provide shade to lower water temperatures. Native shrubs, such as snowberry, aspen, serviceberry, and ponderosa pine, were planted to establish a riparian buffer. Girl Scouts and elementary school students participated in the planting (Figure 56 and Figure 57).

Figure 56: Styner riparian area before planting

Figure 57: Styner riparian area after planting

Sweet Avenue: Meander, Floodplain, Wetland Construction, and Riparian Planting

Partners and local matching funds came from the Idaho Water Resource Research Institute, David Evans & Associates, University of Idaho classes and students, and community volunteers. The project included wetland restoration over an 11,553 square foot area and stream bank restoration along a 1,750 foot-long interval of Paradise Creek where it flows along Sweet Avenue, between South Main Street and College Avenue on the University of Idaho campus in Moscow.

Previous Conditions: This section of Paradise Creek had been channelized and straightened. Eroding banks rose steeply on both sides. Lack of vegetative cover allowed solar radiation to warm the stream. These conditions presented minimal habitat value for wildlife. Furthermore, a parking lot was scheduled for construction adjacent to the stream, and this restoration project provided opportunities to create bio-filtration systems for the future parking lot runoff. The floodplain had been occupied by a concrete batch plant and by a pesticide and diesel storage facility. Hazardous waste cleanup was conducted by the State of Idaho.

Description of Completed Activity: PCEI constructed channel meanders, a narrower low-flow channel, and a more functional floodplain. The meanders provide increased surface area for infiltration and reduced water velocity, and the constructed low-flow channel, sized for 2-year flows, benefits the aquatic biota. (The riparian floodplain was built to contain a 500-year event and provide water storage during storm events.)

Water quality is improved as suspended sediment and associated pollutants settle out on the floodplain during flood events. Hydrologic modeling showed that the constructed two-stage flood channel would not cause a rise in 100-year flood elevations. In fact, the modeling showed a drop in localized flood elevations of up to 1.5 feet.

The floodplain was planted with native riparian vegetation.

Stream banks were resloped and sculpted for stabilization purposes, then covered with geotextile fabric to prevent erosion. Some of the stream banks were terraced and geotextile fabric applied in a stairstep fashion to form earthen *burritos*, or soil wraps. Red-osier dogwoods were sandwiched between the burritos to provide future bank stabilization with their root systems. Twenty-foot logs made of coconut fiber, called BioLogs®, were interlocked, lining the stream course to prevent bank erosion. The entire area was hydroseeded with grass and planted with native woody vegetation. These plants, in addition to their future aesthetic and erosion control value, will provide cooling shade to the stream and thereby increase the amount of dissolved oxygen available to fish and other aquatic organisms. In addition, this vegetation acts as a food and cover source for a diversity of wildlife, including songbirds, amphibians, and mammals.

The Sweet Avenue project also included the construction of grassy swales and “pocket” wetlands. These swales, or biofilters, are structural Best Management Practices (BMPs), designed to treat storm water runoff from the adjacent parking lot. The pocket wetlands, which were built in the bank of the existing stream channel, currently treat storm water runoff as well as water flowing into Paradise Creek during higher flow events.

The restored stream corridor will serve as a research site for the University of Idaho, providing students and faculty with an example of riparian ecology for research in biology, hydrology, environmental sciences, aquatic ecology, engineering, and other sciences.

This project included a baseline- and effectiveness-monitoring component that documented biological, chemical, and physical components of Paradise Creek at the Sweet Avenue reach and other sites within the City of Moscow for comparison. Bioaccumulation data was also collected, which may provide valuable information for restoring coldwater biota and salmonids in the Paradise Creek Watershed (Figure 58).

Figure 58: Sweet Avenue riparian planting

Moscow Wastewater Treatment Wetlands: Treatment Wetland Construction and Riparian Planting

Partners and matching funding came from the University of Idaho, Moscow Wastewater Treatment Plant (City of Moscow), Idaho Water Resource Research Institute, Church of Latter Day Saints, Paradise Creek Bicycles, AmeriCorps *NCCC, and community volunteers.

The project, located downstream of the Moscow Wastewater Treatment Plant, began in 1996 and has been intermittently worked on through 2003. The project includes a 130,680 square foot wetland and 1,300 feet of stream bank restoration.

Previous Conditions: The area was a seasonally wet cattle pasture, dominated by reed canary grass, meadow foxtail, and smooth brome. The goal of this project was to develop wastewater treatment wetlands to provide tertiary treatment to Moscow Wastewater Treatment Plant effluent and other polluted nonpoint source runoff that drained directly into Paradise Creek.

Description of Completed Activity: In conjunction with the Idaho Water Resource Research Institute and the City of Moscow, wetland cells were constructed to naturally filter the polluted water through sedimentation, filtration, absorption, microbial metabolism and plant tissue uptake, thus removing organic matter, excess nutrients, sediment, and trace metals. PCEI hired Elisabeth Brackney, who developed the conceptual design for this project while working on her masters degree in Fisheries Resources at University of Idaho, to consult on the design, along with TerraGraphics Environmental Engineering. In addition, PCEI hired Ecosystems Northwest to delineate existing wetlands on the site, which were discovered to have been completely drained and tiled.

In July of 1996, PCEI hired ME Construction of Potlatch, Idaho, to construct six surface flows, one subsurface flow, and two natural contour surface flow wetland cells, as well as two biofiltration swales and a storm water pond. Local community volunteers, along with University of Idaho and Washington State University students, helped PCEI plant the newly constructed cells with 23,860 native herbaceous wetlands plants, which were contract grown by Wildlife Habitat Institute of Princeton, Idaho. University students were involved in the design, engineering, construction, and planting phases, which were completed in 1998. PCEI has given tours of the site to classes from both universities and to local groups like the Native Plant Society.

More recently, the scope of work at the treatment wetlands included weeding and tree tube maintenance of woody vegetation. PCEI staff and volunteers also performed intensive noxious weed control, using hand tools, weed trimmers, and mowers during the summers of 2002 and 2003.

No photographs are available.

White Avenue: Stream bank Stabilization and Revegetation

Project Partners and local matching funds came from the City of Moscow, AmeriCorps*NCCC, University of Idaho students, and community volunteers. The project, completed along a stretch of Paradise Creek between the Latah County Fairgrounds and Blaine Street in Moscow, took place during September 2002 and Spring 2003 and includes 358 feet of stream bank restoration.

Previous Conditions: The stream segment had near vertical, slumping, eroding stream banks with little vegetation that contributed to the sediment load in the creek. Paradise Creek had been dredged in this reach many different times, which added to its degraded state. In the past, the City of Moscow dumped asphalt onto the sides of the bank in an effort to stabilize the side.

Description of Completed Activity: The purpose of this project was to reslope the stream bank to a 2:1 or 3:1 slope from its near-vertical state reduce erosion, and allow for the establishment of woody vegetation. The project site is 358 linear feet of a heavily damaged, ditch-like creek. The stream bank is composed almost entirely of fill, especially gravel and concrete chunks. After removal of the debris, the site was hydroseeded with a native seed mix and then covered with erosion control fabric. Snowberry and Wood's rose were planted on the site. A few sedges and rushes were planted at the toe of the slope (Figure 59).

Figure 59: Moscow wastewater treatment wetlands planting

Paradise Creek Rural Riparian Restoration Summary

The Paradise Creek Rural Riparian Restoration Project began in 1999 and continues to date. This summary contains pertinent information, including photographs for eleven rural sub-projects:

- Brockington Riparian Planting
- Forbes Wetland Construction and Riparian Planting
- Garton Hardened Rock Stream Crossing
- Hall and Mountain View Gully Projects Stream bank Stabilization and Riparian Planting
- Harden Riparian Planting
- Morton Meander, Floodplain, Wetland Construction, and Riparian Planting
- Morton Extension Channel Remeander and Riparian Planting
- Remington Riparian Planting
- Townsend Re-meander, Floodplain Excavation, and Riparian Planting
- Willard Sediment Catchment, Wetland and Riparian Planting
- Big Draw Riparian planting

All of these sub-projects are located in the rural Paradise Creek watershed upstream of the City of Moscow (Figure 60). All of the sub-projects were funded through the NPS 319 grant. Partners and local matching funds came from a wide variety of sources.

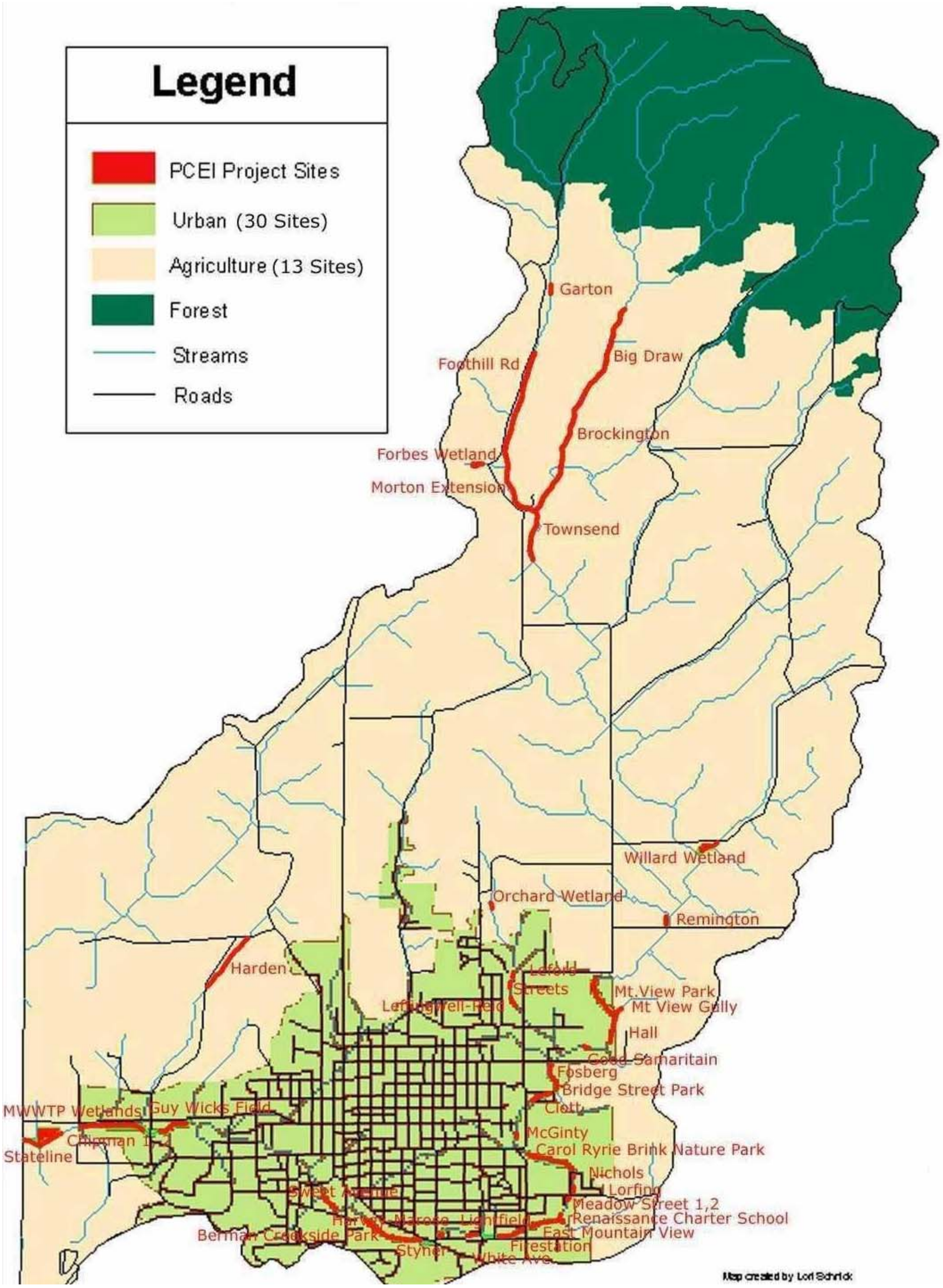

Figure 60: Paradise Creek Watershed Urban and Rural Projects, Moscow Idaho

Brockington Riparian Planting

Partners and local matching funds for this project came from Judy Brockington**,** Steve and Laura Nidlow, Larry McMillan, Clint Townsend, University of Idaho students, Girl Scout troops, AmeriCorps *NCCC, Washington State University students, the University of Idaho Community Service Learning Center, University of Idaho Environmental Club, Church of Latter Day Saints, National Tree Trust, Russell Elementary School, and Boy Scout troops. Project installation, located approximately 3.5 miles north of Moscow, Idaho, occurred from April 2003 through October 2003.

Previous Conditions: Reed canary grass lined the banks of the two Paradise Creek tributaries flowing through the Brockington property. Active wheat fields were directly adjacent to the stream. A riparian buffer was absent in this section of the creek, which exposed the creek to direct solar radiation as well as runoff containing sediments, nutrients, and pesticides. There were multiple equipment crossings through the eastern tributary.

Description of Completed Activity: The scope of this project was to plant a variable width buffer along the two tributaries on this property, including a total length of 2,500 feet. The riparian buffer ranges from 10 to 40 feet in width and consists of native shrubs and trees. The buffer area of the eastern tributary was also seeded with native grass seed. PCEI completed minimal excavation along the eastern tributary to create a narrow, low flow channel with associated floodplain, in conjunction with the adjacent Townsend project. In addition to the excavation coordinated by PCEI (the current agricultural operator), Larry McMillan contributed by excavating the sediment-laden channels of both tributaries. McMillan's work included excavating to the level of the culvert below the Brockington driveway. The Brockington project borders the Big Draw project to the north and the Townsend project to the east and south, therefore it is expected to have significant benefit as a wildlife corridor as vegetation matures (Figure 61 and Figure 62).

Figure 61: Brockington Riparian Area prior to planting woody vegetation

Figure 62: Brockington Riparian Area immediately after woody vegetation was planted. Farm equipment will be restricted to designated waterway crossings. Plastic collars protect young plants from deer and elk until plants become established.

Forbes Wetland Construction and Riparian Planting

Partners and local matching funds for this project came from Washington State University environmental science students, the University of Idaho Community Service Learning Center, Lapwai Elementary School Students, Nez Perce Tribe, and community volunteers. The project, located north of Moscow, Idaho near Moscow Mountain, included work along 820 feet of stream channel and installation of three wetlands for a total of 12,800 square feet. Wetland excavation occurred on July 25, 2003. Plantings were completed in September and October 2003.

Previous Conditions: This seasonally wet draw with intermittent springs collects a significant amount of water from the surrounding hills and is a tributary to Paradise Creek in the spring. In the past, this draw has been utilized as horse pasture. The Forbes family recently purchased the property and decided to enhance its value as native habitat and improve its water quality. Prior to restoration, reed canary grass, meadow foxtail, morning glory, and other invasive weeds dominated ground cover. There was little vegetative diversity at this site.

Description of Completed Work: The scope of work for this site was to construct several wetland benches. The goals of the project were to increase the flood storage capacity of the draw, provide a place for sediment to settle, increase biological diversity with native species, improve water quality of this small tributary, and establish a shallow channel to allow wetlands overflow to flow into Paradise Creek.

All exposed soil was seeded and mulched after construction. Species used were fowl bluegrass, tufted hairgrass, ticklegrass, prairie junegrass, and yarrow. Native woody and herbaceous vegetation was planted in the fall of 2003. Herbaceous plants will continue to be planted over the next few years as the storage capacity and other characteristics of the wetlands become more apparent. PCEI organized a planting of 150 camas bulbs in October 2003 with students from Lapwai Elementary School. The students learned about the cultural and ecological significance of camas in addition to helping restore the species (Figure 63 and Figure 64).

Figure 63: Forbes area in Spring 2003, prior to wetland construction and riparian planting

Figure 64: Forbes area after Fall 2003, including wetlands and woody riparian plants

Garton Hardened Rock Stream Crossing

Partners and local matching funds for this project came from Oz and Virginia Garton, Latah County Youth Services, and community volunteers. Project installation occurred on August 21, 2003.

Previous Conditions: This section of Paradise Creek, located three miles north of Moscow, has populations of quaking aspen, Douglas hawthorn, snowberry, serviceberry, cow parsnip, and many other species that compose a healthy riparian buffer. Restoration effort targeted a specific problem area disturbed by an established horse crossing that provided access to pasture on both sides of the creek. Prior to restoration, continuous use of the stream section for animal passage contributed to nutrient and sediment inputs. The presence of large stands of Canada thistle in proximity to the creek was also of concern.

Description of Completed Activity: The project was designed to minimize disturbance to the riparian area and to improve water quality along this reach of Paradise Creek. The long-term goals of this project include the following:

- Improved water quality though construction of a hardened rock crossing that limits creek disturbance while still providing access to pasture.
- Minimized erosion from animal impact by concentrating the animal traffic to an area properly constructed to withstand animal use.

Mark Hawley of Moscow was hired to do shallow excavation and to place the rock fill. Rock, eight inches or less in diameter, was used to fill the depression, and a two foot strip of gravel dressing was placed down the middle of the crossing to lessen the possibility of injury to the animals. Filter fabric was installed beneath the rock. Project construction lasted about five hours. Figure 65 and Figure 66 show the crossing before and after the work was accomplished.

Figure 65: Garton Stream before the work

Figure 66: Garton Stream after the work

Hall and Mountain View Gully Projects Stream bank Stabilization and Riparian Planting

Partners and local matching funds came from AmeriCorps*NCCC, University of Idaho classes and individual students, Washington State University classes, and community volunteers. Project installation occurred during Fall 2002. This site is located between Mountain View Park and D Street on the east side of Paradise Creek, in Moscow.

Previous Conditions: These stream segments had slumping, eroding stream banks that were frequently undercut during heavy storm events, contributing sediment to Paradise Creek. In addition, annual dredging artificially widened and incised the stream channel. Widening of the stream and the lack of shading caused the water to heat up during low flow periods of the year. Lack of a riparian buffer allowed direct flow of agricultural runoff into the creek. Reed canary grass was the dominant cover type. Canopy cover and wildlife habitat were minimal along this segment of the creek.

This project addressed two gullies that were forming on the site. The first gully was beginning to form at the southeastern end of Mountain View Park, near the end of a drainage pipe. The gully averaged approximately 2– 4 feet deep, and the gully opening was 10 feet wide at the entrance to the creek and 2 feet wide at the back. A second gully was forming approximately 200 feet downstream from the first gully; this gully was approximately 20 feet long and 2 to 5 feet deep, and approximately 11 feet wide downstream and 2 feet wide upstream.

Description of Completed Activity: PCEI resloped approximately 740 linear feet of the heavily damaged, ditch-like creek to a low-flow channel with a terraced floodplain. Approximately 1,568 cubic yards of soil was excavated from this site, and the excavated soil was spread on the Hall property. The newly constructed low-flow channel has a bottom width of 3 to 4 feet, compared to the old channel-width of 10 feet. The overall shape of the channel is a “V”.

PCEI used bioengineering techniques to stabilize approximately 41 feet of gully to reduce erosion. Geotextile fabric was installed on exposed soil by PCEI staff and volunteers, and in the spring of 2003, shrubs, trees and grasses were planted along the bank to introduce shade to the stream. The woody riparian buffer is 30 feet wide with 2,325 native woody and herbaceous plants.

Woody riparian buffers offer many benefits, including filtration of runoff, wildlife habitat, soil stabilization, sediment trapping, and floodwater retention. These plantings will be protected from vole damage with plastic tubes. The plants were weeded and watered during the summer of 2003 by AmeriCorps*NCCC members.

Figure 67 shows the near vertical bank cut before the work was completed and Figure 68 shows the bank after work was completed.

Figure 67: Hall and Mountain View Gully before work

Figure 68: Hall and Mountain View Gully after work

Harden Riparian Planting

Partners and local matching funds came from a Washington State University environmental science class, AmeriCorps*NCCC, and community volunteers.

This project, installed on March 29, 2003, includes 1,720 feet of stream bank restoration.

Previous Conditions: Prior to restoration, the channel of this tributary to Paradise Creek had been straightened to allow for cultivation to the stream's edge. Reed canary grass lined the banks of the creek, and active wheat fields were directly adjacent to the stream on the east side (Figure 69). A riparian buffer was absent in this section of the creek, which exposed the creek to direct solar radiation as well as agricultural runoff containing sediments, nutrients, and pesticides.

Description of Completed Activity: The purpose of this project was to create a riparian buffer along an 860-foot reach of a tributary to Paradise Creek, so 563 trees and shrubs were installed along the stream channel. Woody riparian buffers offer many benefits, including filtration of runoff, soil stabilization, wildlife habitat, and floodwater retention. These plantings will be protected from vole damage with plastic tubes. The plants in Figure 70 were watered and weeded on multiple occasions in 2003.

Figure 69: Harden Riparian Area prior to work

Figure 70: Harden Riparian Area after work completed

Morton Meander, Floodplain, Wetland Construction, and Riparian Planting

Partners and local matching funds came from the Latah Soil & Water Conservation District, Natural Resource Conservation Service, Idaho Soil and Water Conservation Commission, Bon Terra, Wildlife Habitat Institute, Church of Latter Day Saints members, AmeriCorps*NCCC, National Tree Trust, University of Idaho and Washington State University classes and students, Ron Morton, Moscow High School students, and community volunteers.

This project located near Moscow Mountain, on Foothill Road north of Moscow, includes 7,200 feet of stream bank restoration and two wetlands covering 115,650 square feet.

Previous Conditions: Prior to restoration, the stream channel was straightened and acted as a drainage ditch along Foothill Road. Reed canary grass lined the banks of the creek, and active wheat fields were directly adjacent to the stream. A riparian buffer was absent in this section of the creek, which exposed the creek to direct solar radiation as well as storm water runoff containing sediments, nutrients, and pesticides.

Description of Completed Activity: This rural riparian restoration project will demonstrate the effectiveness of maintaining a riparian buffer strip along agricultural stream channels. The primary long-term benefits from this project will include the following:

- Establishing native riparian vegetation along the creek to provide habitat for fish and aquatic invertebrates, a corridor for migratory wildlife, and habitat for resident wildlife
- Improving water quality due to riparian vegetation shading and filtration and trapping of sediments, nutrients, and organic matter from runoff before it reaches the creek
- Restoring hydrological diversity within the creek through installation of meanders that resemble the creek's historical path

To accomplish these ends, riparian floodplain, meandering stream channel, and associated wetlands were constructed and vegetated with native woody vegetation, grasses, and emergent herbaceous wetland plants.

TerraGraphics Environmental Engineering designed the re-constructed stream channel and wetlands. The main channel cross section was designed to accommodate the calculated 2-year, 24-hour flow of 25 cubic feet per second (cfs). The floodway of the new channel was designed to accommodate up to 147 cfs, the flow rate of a localized 100-year flood event. Two wetlands approximately 12 inches deep were excavated adjacent to the newly meandered stream to receive runoff before it enters the stream, to act as a flood storage and groundwater recharge area, and to provide habitat for wildlife.

Stream channel meanders were constructed during low stream flows (mid July – early August) to minimize erosion resulting from construction. The stream was relocated to follow its estimated historical path approximately 200 feet east of its prior location, and the meanders were installed to follow the natural contours of the land, determined by a survey of topographical features, old aerial photographs, and clues from the current natural runoff flow.

Volunteers from the Church of Latter Day Saints and other community volunteers helped stabilize the newly constructed stream banks with geotextile fabric and coir logs. The entire stream channel was lined with coconut fiber BioLogs® and pre-planted with wetland vegetation. These activities stabilize the toe of the stream banks, maintain the newly constructed meanders, catch sediments from runoff to the creek, and help filter nutrients from the water as it travels downstream.

In the fall of 1999, the stream channel, floodplain and adjacent land was seeded, by hand and with farm equipment, with a riparian grass mix. The following spring, PCEI volunteers and the Mortons planted a 150 foot wide buffer strip with a mix of native woody plant species. The first 30 feet on either side of the creek was planted by PCEI; the remaining 120 feet was planted by a private company contracted by the landowners, with assistance from the continuous riparian buffer strip Conservation Reserve Program, to form a 150 foot buffer strip on each side. The two wetlands were seeded with locally collected wetland plant seeds.

The stream banks were planted with red-osier dogwood (*Cornus sericea*) and willow spp (e.g. *Salix exigua*). Adjacent to the stream channel, and up to 30 feet from the channel, the following species were planted: water birch (*Betula occidentalis*), aspen (*Populus tremuloides*), rocky mountain maple (*Acer glabrum*), black cottonwood (*Populus trichocarpa*), mountain ash (*Sorbus scopulina*), Douglas hawthorn (*Crataegus douglasii*), chokecherry (*Prunus virginiana*), serviceberry (*Amelanchier alnifolia*), and blue elderberry (*Sambucus cerulea*). Herbaceous cover was established by fall to provide ground cover and maintain stream channel integrity during the upcoming winter and spring thaw.

A riparian functioning assessment team organized by the Latah County Soil and Water Conservation District will monitor this site annually to determine the effectiveness of the stream restoration efforts towards improving biological diversity and viability and water quality. Furthermore, the site was marked with a sign and will be accessible to the public, providing a demonstration site to show the benefits of riparian habitat along waterways, illustrating that such methods can be used to complement current farming practices.

Subsequent work was completed during Spring 2002 and Spring 2003, including 1,790 feet of stream bank restoration. Due to difficult growing conditions, including hard clay soils and vole damage, vegetation failed to establish along some sections of the stream. In the spring of 2002, quaking aspen and red osier dogwood plugs from the National Tree Trust were planted around the wetlands and in other un-vegetated areas.

In the spring of 2003, willow and cottonwood poles, and red osier dogwood plugs were planted on the stream banks in spots lacking woody vegetation. Fascines were constructed from live cottonwood and willow cuttings and were placed where banks were bare and sloughing into the creek during high flows. Native wetland plugs, including small-fruited bulrush, Nebraska sedge, and Baltic rush were planted along bare sections of the streams. These deep-rooted plants will hold the stream bank in place and filter sediment and nutrients from the stream. Ponderosa pines from the National Tree Trust were also planted adjacent to the stream to provide long-term shade, contribute woody material to the stream system, and provide wildlife habitat. All work was done with the help of AmeriCorps*NCCC teams (Figure 71 and Figure 72).

Figure 71: Predator bird habitat structure Summer 2003

Figure 72: Stream bank stabilization being installed Summer 2003

Morton Extension Channel Remeander and Riparian Planting

Project partners and local matching funds came from Ron Morton, University of Idaho (UI) students, UI Circle K, Washington State University (WSU) students, WSU service learning, and community volunteers. During Fall 2003 2,700 feet of stream bank restoration was conducted East of Foothill Road, north of Moscow.

Previous Conditions: Prior to restoration, the stream channel was nearly straight and was largely overgrown by reed canary grass. There was no native vegetation present other than a few native wetland plants. The reed canary grass monoculture provided little shade to the stream and little wildlife habitat. The lack of woody vegetation and prevalence of fine silt in this section of stream encouraged the development of an excessively wide, shallow channel. In addition, downstream landowners were concerned about flooding resulting from the channel silting in.

Description of Completed Activity: A new “E” type stream channel, approximately 1’ wide and 10” deep was dug with a trackhoe. Channel sinuosity was increased by the inclusion of numerous meanders in the newly constructed channel, doubling the channel length within this reach. An increase in sinuosity will encourage more natural sediment deposition, develop stream-associated wetlands, and reduce stream velocity and thus erosive force.

Native riparian shrubs were planted after channel construction. A riparian buffer of woody vegetation will shade the stream, reduce water temperatures, stabilize soil, filter runoff from adjacent roads and farm fields, and contribute woody material to the stream system (Figure 73 and Figure 74).

Figure 73: Morton extension area prior to work

Figure 74: Morton extension. Area after work completed

Remington Riparian Planting

Partners and local matching funds came from George Remington, University of Idaho students, Washington State University students, University of Idaho Forest Research Nursery, and the Wildlife Habitat Institute. Project installation, including 400 feet of stream bank restoration, occurred on June 12, 2001.

Previous Conditions: Prior to restoration, the stream channel, a tributary to Paradise Creek, ran through a former hay field, which had previously been grazed and mowed up to the eroding stream banks. The field was losing several inches of ground during high flood events, and lacked habitat complexity. A riparian buffer was absent in this section of the creek, which exposed the creek to direct solar radiation and runoff containing sediments, nutrients, and pesticides.

Description of Completed Activity: The purpose of this project was to create a riparian buffer strip along a 400 ft. reach of a tributary to Paradise Creek. The landowner mowed the swath along the stream that he was interested in having planted, and University of Idaho and Washington State University volunteers assisted in planting a variety of shrubs and trees (many snowberry shrubs were donated by the University of Idaho Forest Research Nursery and red-osier dogwoods were donated by Wildlife Habitat Institute). Woody riparian buffers offer many benefits, including filtration of runoff, soil stabilization, wildlife habitat, and floodwater retention. These plantings will be protected from vole damage with plastic tubes.

No photographs are available.

Townsend Remeander, Floodplain Excavation, and Riparian Planting

Partners and local matching funds came from Clint Townsend, Larry McMillan, a Washington State University science class, University of Idaho students, Cub Scout troops, Girl Scout troops, Washington State University Community Service Learning Center, CAMPOS Student Organization, University of Idaho Community Service Learning Center, University of Idaho Environmental Club, Alternative Breaks Association, University of Idaho Bonner's Scholar Program, Lake City High School faculty, and community volunteers.

Project installation, including 3,775 feet of stream bank restoration, occurred during Fall 2003.

Previous Conditions: Due to agricultural development, the stream was braided into several small channels with steep, eroding banks in many places. The site was cultivated to the edge of the stream channel and no riparian vegetation existed. Reed canary grass lined the 40 foot wide braided channel. Our goals were to improve the water quality of the two tributaries that flow through the Townsend property, to increase diversity of native riparian vegetation, and to create habitat for wildlife. Water quality improvements focus on nonpoint source pollutants like temperature, sediment, nutrients and bacteria. Improvements at this site will contribute to improving water quality in the mainstem of Paradise Creek.

Description of Completed Activity: The scope of work included excavating the floodplain, defining a narrow, low flow channel and planting a riparian buffer of woody and herbaceous species. Excavation occurred in September 2003. Excavation was done in two phases. The downstream end, below the confluence of two tributaries was completed first and excavation of the eastern-most tributary was second. The channel was constructed using an excavator and excess soil was spread outside the floodplain on the Townsend property using a bulldozer. A multi-level floodplain was constructed to accommodate varying flow levels. Meanders were constructed in the new stream channel. A two layered soil wrap revetment was constructed on the downstream end of the project to protect against further erosion of a previously existing scour pool. After construction, all exposed soil was seeded with native grasses and banks were covered with erosion control fabric. In October and November 2003, a riparian buffer of native trees and shrub, varying in width from 45 to 90 feet, was planted on either side of the stream (Figure 75 and Figure 76).

Figure 75: Townsend Waterway prior to reclamation

Figure 76: Within one year Townsend waterway will have stable banks and support sustainable, healthy riparian vegetation.

Willard Sediment Catchment, Wetland and Riparian Planting

Partners and local matching funds came from North Latah Highway District, AmeriCorps*NCCC, community volunteers, Janice Willard, Bill Styer, and Washington State University students. The project was installed on November 7, 2001, with additional planting completed in spring 2003. The project, including 618 feet of stream bank restoration and one wetland covering 10,197 square feet, is located 0.5 mile east of Mountain View Road, between Darby Rd. and Moscow Mountain Rd north of Moscow.

Previous Conditions: Stream banks along this tributary to Paradise Creek were eroding due to a lack of woody vegetation and steep banks. Reed canary grass formed a dense monoculture, whose shallow root mats did not prevent slumping of the stream bank. Thus, stream banks were frequently undercut during heavy storm events. The lack of trees or woody vegetation along this stream segment allowed direct solar radiation to heat the stream water. There were also high levels of sediments in this tributary that added to the sediment loads of Paradise Creek.

Description of Completed Activity: The main purpose of this project was to create a sediment catchment system to trap sediment-filled high water. Another goal was to stabilize and revegetate a 300-foot section of the tributary to provide habitat for wildlife, provide shade to reduce stream temperatures, provide a vegetated buffer from agricultural runoff, and reduce the amounts of sediments entering the stream. Earth moving was completed by Professional Operators Company. PCEI staff and volunteers completed the bank stabilization activities. The catchment banks were sloped to a 3:1 slope. This moderate slope reduces erosion, reconnects the stream to its floodplain, and creates a prime area for native vegetation. The resloped banks were seeded with a riparian grass mixture and covered with geotextile fabric. Native woody vegetation was planted in the spring of 2002. All excavated material was removed off-site. In selected areas (Figure 77), coconut fiber-filled BioLogs®, pre-planted with wetland plants, were installed along the toe of the stream bank for stabilization and to improve water quality through the water-filtering qualities of wetland plants. Woody debris of cedar and pine were installed in the catchment to act as a filter and, in turn, to slow the velocity of the water so sediment could settle out. Planting of native woody and herbaceous vegetation was completed in the spring of 2002 by PCEI staff and volunteers.

Figure 77: Biologs® stabilize stream bank

Big Draw Riparian planting

Partners and local matching funds came from the Natural Resource Conservation Service, Idaho Fish and Game, Whitman College Alternative Spring Break, Latah County Youth Services, Delta Chi Fraternity, AmeriCorps*NCCC, National Tree Trust, Church of Latter Day Saints, Latah Trail Foundation, Oz and Virginia Garton, and community volunteers. The project was installed over the spring and fall of 2002 and spring of 2003.

The project, located at Big Draw near Moscow Mountain north of Moscow, includes 5,725 feet of stream bank restoration.

Previous Conditions: The stream channel had been straightened for agricultural development. The channel was deeply incised in some stretches, and the vegetation was a monoculture of reed canary grass. The steep, bare banks eroded during high water events. The lack of woody native vegetation along the stream channel contributed to bank erosion and high water temperatures for this stretch of the stream.

Description of Completed Activity: Thousands of native trees and shrubs, mostly Douglas hawthorn, ponderosa pine, and Nootka rose, were planted along the stream channel to establish a woody riparian buffer. As the vegetation matures, it will shade the stream channel, stabilize eroding banks, and contribute woody material to the stream channel. Woody debris in the channel will increase channel diversity, provide habitat, and help reduce channel incision.

No photographs are available.

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